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U. S. S. Vulcan a Floating Machine Shop.

One of the most interesting and important vessels of our fleet in front of Santiago is one that we do not hear much about, because she is not designed for fighting, but to keep other vessels in condition for fighting. While every modern war vessel is a "fighting machine" the Vulcan is a movable "machine shop," designed to take the repairing facilities of a good sized plant right along with the fleet, where they are most needed, so that for anything short of a complete smash-up it will not be necessary for the vessels to leave their station for repairs and refitting. Of course, all our modern steamers have a little machine shop of their own, and the work done is really highly creditable to the engineers and mechanics, but the capacity of a lathe with 14 to 16 inches swing and 5 or 6 feet length, and of an 8 or 10 inch shaper, and a small drill press is necessarily limited, while the job of bending and fitting 6 inch or larger copper pipe, or of retubing several boilers in a short time, mean facilities and men which an ordinary ship cannot possibly have. It is for the purpose of supplying all these needs that the repair ship has been devised.

The Vulcan is not, of course, the first ship of this class, as the British have for some years had a vessel of the same name as a torpedo depot ship. The following description of her is from a lecture at the Naval War College by P. A. Engineer W. M. McFarland, U. S. Navy.

She is 350 feet between perpendiculars, 58 feet beam, and has a displacement of 6,630 tons at 23 feet mean draught. She has a bunker capacity of 1,000 tons, and machinery of 12,000 horse-power, which is expected to give her a speed of about 20 knots, the idea being that she would not only serve as a repair ship, but could be used for scouting purposes, and also for offensive movements. In a description of her recently printed it is stated: "She is intended to accompany a fleet to sea, to form a depot for supplying mining and countermining stores, electrical gear, Whitehead torpedoes, etc.; to assist in the work of laying out mines or fishing them up, as occasion may require, as well as forming a school of instruction for this kind of work in times of peace. She is also fitted with a factory for executing repairs to torpedo gear and boats, and to such ships of war as are not provided with the means of performing their own repairs.

"In the workshop there are five lathes of various sizes from 15-feet bed and 9-inch centers down to 3 feet 6 inch beds and 6-inch centers: two drilling machines, planing, slotting, shaping and punching machines, and a circular saw bench, a carpenter's bench, fitters' benches, and a Fletcher's air furnace capable of melting down two hundred weight of scrap steel in two hours. In the blacksmith shop, on the upper deck, is a powerful hydraulic forging press, a large forge fitted with Root's blower and steam blast, and also a coppersmith's forge and pipe-bending machine, together with a complete set of tools."

Other nations have also constructed similar ships, as shown by the following extracts from the lecture already referred to:

In the French navy the Foudre is a torpedo depot and repair ship somewhat smaller than the Vulcan. She has a displacement of 5,970 tons, and with 11,400 I. H. P. is expected to make 19 knots. She has eight 3.9-inch, four 2.5-inch and four 1.8-inch quick firing Canet guns, and five torpedo ejectors. She will carry ten second-class torpedo boats. No list of her tools is available.

The Austrians have also a repair ship in the Pelican, of about 3,000 tons displacement, which has made about 18 knots with 4,800 I. H. P. The machinery is by Schichau.

In 1887 the transatlantic liner America was purchased by Italy for a torpedo depot and repair ship. She has a displacement of 9,550 tons on 26 feet mean draught, and compound engines of 9,000 I. H. P., which are said to have given a speed of 18.5 knots. She has bunker capacity of 1,550 tons. Her large size gives unusual facilities as a store ship. Late reports state that she had been found very useful.

During our civil war there were repair ships at the principal blockading headquarters, but these were usually hulks or sailing vessels, and so missed the great advantage of a modern repair ship in being able to proceed anywhere with the fleet.

Our Vulcan was formerly the S. S. Chatham, of the Merchant and Miner's line, running from Baltimore to Boston, a vessel of about 2,700 tons register, and well adapted for conversion to her present purpose. Through the courtesy of Commodore Melville, engineer-in-chief of the navy, we are able to give the illustration herewith, showing the design for the location and arrangement of the principal tools. It will be observed that a foundry forms part of the plant, having a cupola and brass furnaces. It is not, of course, expected to do much if any casting at sea in rough weather, as the Vulcan, when at work for the fleet, would usually be in a sheltered harbor.

The following is the list of tools as originally planned, but as it was of the utmost importance to get the ship fitted out as rapidly as possible, the sizes were varied somewhat when it would insure the quicker delivery of any of them. Several of the leading firms were invited to assist in the outfit, but most of the tools were supplied by a single firm of dealers in New York.

MACHINIST'S.

1 lathe, gap, 40 inches swing, 20 feet centers.

2 lathes, 30 inches swing, 10 feet centers.

Each of the above to be fitted with boring bar with traveling head.

4 lathes, 18 inches swing, 6 feet centers.

1 lathe, 12 inches swing, 4 feet centers.

1 lathe, monitor, small.

1 planer, to take 4 feet square, 10 feet travel.

2 planers, to take 3 feet square, 5 feet travel.

1 shaper, 24 inches stroke.

1 shaper, 14 inches stroke.

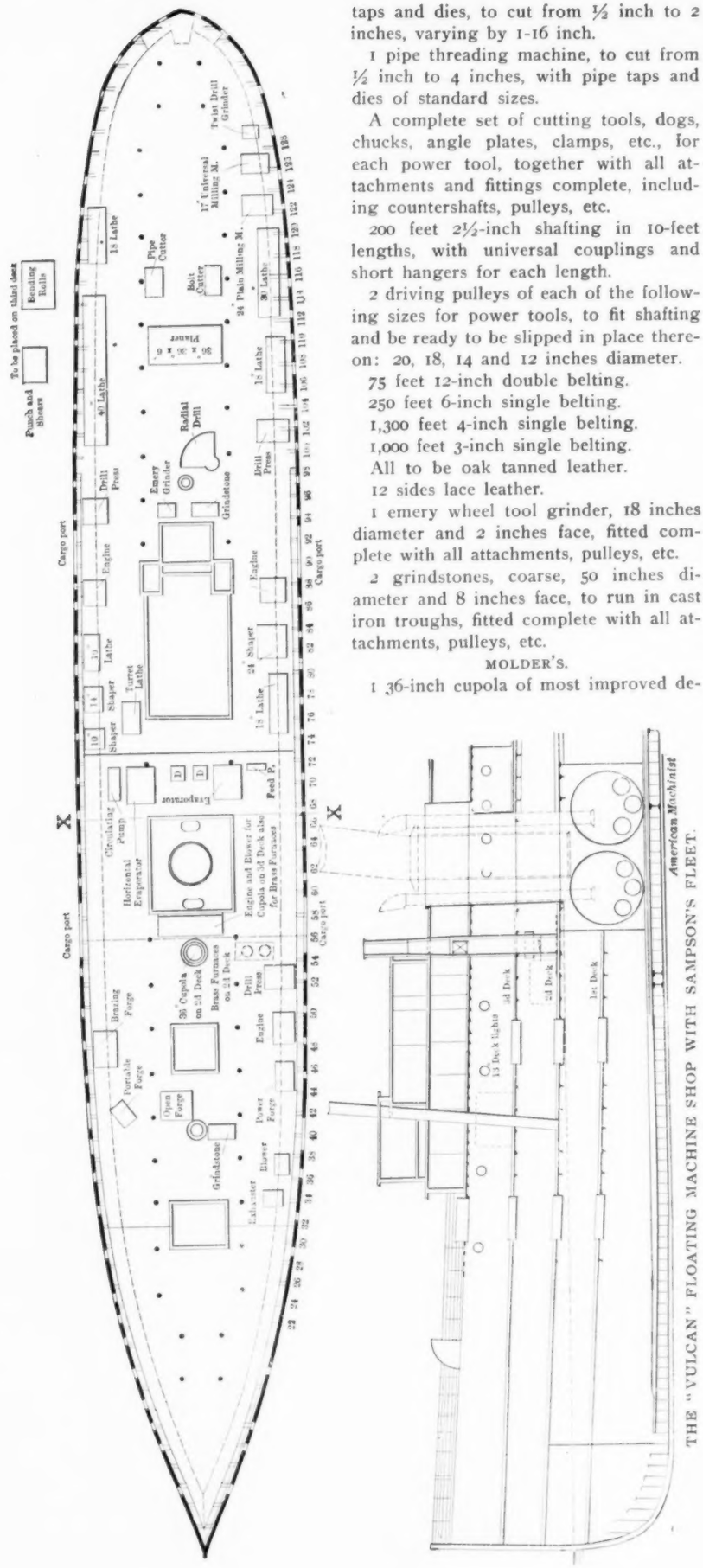
1 shaper, 10 inches stroke.

1 radial drill, to drill at 48 inches from side of column.

2 drill presses, 3-inch spindle, to drill up to 1½-inch holes, 12 inches vertical movement.

2 drill presses, 2-inch spindle, to drill up to 1-inch holes, 12 inches vertical movement.

1 bolt cutting machine, with standard



THE "VULCAN" FLOATING MACHINE SHOP WITH SAMPSON'S FLEET.

American Machinist

taps and dies, to cut from ½ inch to 2 inches, varying by 1-16 inch.

1 pipe threading machine, to cut from ½ inch to 4 inches, with pipe taps and dies of standard sizes.

A complete set of cutting tools, dogs, chucks, angle plates, clamps, etc., for each power tool, together with all attachments and fittings complete, including countershafts, pulleys, etc.

200 feet 2½-inch shafting in 10-feet lengths, with universal couplings and short hangers for each length.

2 driving pulleys of each of the following sizes for power tools, to fit shafting and be ready to be slipped in place thereon: 20, 18, 14 and 12 inches diameter.

75 feet 12-inch double belting.

250 feet 6-inch single belting.

1,300 feet 4-inch single belting.

1,000 feet 3-inch single belting.

All to be oak tanned leather.

12 sides lace leather.

1 emery wheel tool grinder, 18 inches diameter and 2 inches face, fitted complete with all attachments, pulleys, etc.

2 grindstones, coarse, 50 inches diameter and 8 inches face, to run in cast iron troughs, fitted complete with all attachments, pulleys, etc.

MOLDER'S.

1 36-inch cupola of most improved design, to melt 3,000 pounds metal at each tapping; a blower and engine to furnish blast; hoist, piping and fittings complete.

1 furnace, iron lined, with fire brick, to take three 100-pound crucibles, funnel about 12 inches diameter.

3 sets crucible tongs, 1 set for each size of crucible.

50 crucibles of 50 pounds capacity.

50 crucibles of 100 pounds capacity.

3 crucible bearers for each size crucible.

3 complete sets of molder's tools.

COPPERSMITH'S.

1 brazing forge, with two circular and one long fire, for blast, to be built up in light iron and lined with fire brick.

1 set of tools, including shears, stakes, hammers, beck irons, blocks.

3 tinsmith's furnaces, with soldering irons, pots, etc.

BLACKSMITH'S.

1 open-hearth forge, 5 feet in diameter, with cowl and 12-inch funnel, to be built up of brick and iron, used for heavy forging or flange turning, to be fitted for power blast.

2 forges, with power blast, to weld 4 inches square (16 square inches).

2 forges, portable, with hand blowers, to weld 2 inches square.

1 Sturtevant pressure blower, to be driven by engine attached; a quantity of 3-inch and 2-inch light iron pipe for leading blasts.

3 portable hand blowers, 14-inch fans, driven by levers.

6 Eagle anvils, with blocks, two of 150 pounds, two of 180 pounds, and two of 200 pounds.

1 complete set of forge tools with each forge.

1 surfacing plate.

6 swedge blocks, 200 pounds each.

1 welding block, about 6 inches square and four feet long, with three grooved sides, the grooves 2-inch, 3-inch and 4-inch diameter.

12 hand hammers.

6 flogging hammers.

6 sledges: two 6 pounds, two 8 pounds, two 12 pounds.

BOILERMAKER'S.

50 boilermaker's kits, to include hammers, chisels, caulking tools, drift pins, reamers, scrapers, etc.

12 sets riveting hammers: 8 sets straight pene, 4 sets ball pene.

12 sets roller expanders, from 1¼-inch to 3-inch, varying by ¼ inch.

1 power punch and shears, single machines, 15-inch throat, to punch 1 inch in ⅞-inch plate and shear 15 inches by ⅞ inch.

1 set hand rolls, to be set on upper deck, rolls to be 6 inches diameter by 6 feet long.

6 rivet heating forges.

1 dozen boilermaker's ratchets, short, with square shank drills.

50 each of the following sizes of square

shank drills: ½-inch, 5/8-inch, ¾-inch and 7/8-inch.

6 tube cutters, to cut from 1½-inch to 3-inch tubes.

1 dozen flogging hammers, 4 pounds.

1 dozen sledges, 8 pounds.

6 clubs and sledges, for holding on.

6 screw punches.

4 6,000-gallon evaporators, No. 5, Type B.

4 No. 6, distilling apparatus sufficient for above.

Feed pump, capacity 30 gallons per minute.

Circulating pump, capacity 600 gallons per minute.

1 blower No. 4, 32 by 25 by 33h.

3 exhausts No. 5, 38 by 30 by 37h.

The line shafts are driven by several small engines, conveniently located.

As will be seen from the outfit for the Vulcan, it would be possible to do any lathe work required except for large shafting, and any planer work that would be required by anything short of a complete smash-up of some ship's machinery. Almost any castings which would be needed, short of such a disaster, could be made, and the thousand and one small repairs which are ordinarily made at a navy yard could be just as well made on board the repair ship.

There can be little doubt that in future naval wars every fleet which operates away from its own coast will have one or more of these repair ships as an important adjunct.

Besides this outfit of machine tools the vessel is supplied with a complete outfit of tools for bench and vise work, hydraulic and screw jacks, etc., and probably the finest lot of engineer's stores ever put on a ship. The list has been selected with very great care and in sufficient quantity to completely equip half a dozen vessels. Round steel large enough for the piston rods of torpedo boats, round Tobin and manganese bronze large enough for air pump piston rods, sheet steel and copper, brass and iron pipe and fittings, packing and sheet rubber in all sizes, give a faint idea of this well selected and bountiful supply of stores.

The engineers of the Vulcan are Chief Engineers Jas. H. Chasmar and Gardiner C. Sims and Passed Assistant Engineers John L. Gaw, W. S. Aldrich, J. Alvah Scott and Assistant Engineer F. C. Neilson. Of these Mr. Sims is well known as the builder of the Armington & Sims engine. He devoted himself to the work of fitting out the Vulcan, and his popularity with his own men at home led a number of the very best to enlist on the ship. Messrs. Chasmar and Gaw are officers of the regular navy; the rest are volunteers.

The mechanics are all given the rating of chief machinist in the navy, the pay being $70 per month and a ration. They include 50 machinists, 25 boilermakers, 6 blacksmiths, 6 coppersmiths, 6 molders, 6 patternmakers, 2 carpenters and 40 helpers, rated as firemen, first class. These men also constitute the engineer's force of the vessel, care having been taken to select a sufficient number with sea experience, the rest to be trained in service.

Nor are these men non-combatants. They are organized into crews for the machine guns, and as infantry companies, so that, as one of the officers put it: "Nobody can tell us to 'hold up your hands.'"

On the way down to Santiago, where the Vulcan arrived July 1, the mechanics did duty at the wheel and elsewhere on deck, as well as below with the machinery, and one of the engineers stood a deck watch. This is exactly as it should be, and after the Personnel bill now pending in Congress has been in operation some time we shall not only have every officer an engineer, but every seaman a mechanic, a consummation which will give us a navy of the highest efficiency.

Since her arrival at Santiago the Vulcan has had a busy time. Her men have been divided into three shifts and have kept the tools going the whole twenty-four hours. It would be easier to tell what she has not done than what she has done, for everything is grist for her mill. To the torpedo flotilla she has been a nursing mother, for these little boats are delicate and have nothing but hand tools. She has made new gun gear, new steam pipes, and practically everything needed.

The brass furnaces are in daily use, and several heats have been poured from the cupola with success for iron castings of a more or less complicated character.

It is to be noticed also that the large number of mechanics enables big working gangs to be sent to the ships for overhauling and repair work on board when that is the most expeditious plan.

The ship has already won golden opinions and officers of every class are loud in their praises of her great usefulness. There can be no doubt that a vessel of this kind should be attached to every large fleet operating away from home. Vessels specially designed and built for this work would, of course, be better in many ways, but the Vulcan is fully answering all that was promised and expected of her. The fitting out of this ship is one of the many things done by Commodore Melville and his staff to maintain the efficiency of our fleet, and he deserves the praise of every American for the splendid work he has done.

The need for and the usefulness of such a ship in modern naval operations is only another illustration of the truth strongly brought out during the war now happily ended, *i. e.*, that future naval battles are to be won by those who have the best machines, kept in the best order, and who are skilled in the use of them—mechanicians who are cool and brave.

Sampling and Testing Lubricating Oils and Fats in the Workshop.—II.*

The Action of Alkalies on Oils.—The value of an alkali as a test reagent is threefold, because it serves to distinguish a fat oil from a hydrocarbon oil—fat oils consist of oxygen, carbon and hydrogen, but hydrocarbon oils consist of carbon and hydrogen only—and also serves as a means of ascertaining whether a suspected sample is a mixture of fat and hydrocarbon oils. Alkalies convert oils of the fat series into soaps of a hard or semi-solid nature; but hydrocarbon oils are not so acted on, the product of the mixing of an alkali with a hydrocarbon oil being an emulsion, of which, however, the compounds generally separate again on standing. It is on these facts that a mixture of the two kinds of oil is ascertained.

Action of Alkalies on Fat Oils.—Make a solution of caustic soda or potash having a specific gravity of 1.340 (at 68° Fahr.), put one part by fluid measure of this solution into a long test tube and then pour in two parts fluid measure of the fat oil and shake up the mixture vigorously; a solid mass will be produced—*i. e.*, a soda or potash soap—by the union of the oil and alkali. Allow this to stand undisturbed, when a very small quantity of water will be gathered up beneath the soap. This water has a milky or emulsified appearance.

By making a similar experiment with a hydrocarbon oil no solid soap will be found, but simply an emulsion of the oil and water; but on allowing this to stand undisturbed the oil and water will only exhibit a cloudy appearance, if not absolutely clear.

In the case of a mixture of a fat and a hydrocarbon oil the product formed on making the above test will vary according to the proportion of mineral oil present. If the fat oil predominates very little trace of the hydrocarbon oil will be found, as the solid soap that is formed will hold the hydrocarbon oil prisoner. A common soap makes a very good excipient for carrying hydrocarbon oils, or even turpentine, to be combined with a certain quantity of water. If, however, the hydrocarbon be in excess, it will form a layer on top of the soapy mass, while the water that is not taken up in the soap will show itself emulsified. An accurate test to detect mineral oils in fat oils is the following: Dissolve a piece of caustic soda about the size of a pea in 5 cubic centimeters—written c.c. in future—of alcohol in a test tube; then put in a few drops of the oil to be tested, and heat the mixture over a gas flame, and let it boil for two or three minutes; then add 3 to 4 c.c. of distilled water. If the suspected oil be only a fatty acid the

*Reprinted from "The Engineer," London, and slightly condensed.

solution will remain clear; but if a mineral oil be present, even to the extent of only 2 per cent., the solution will be tinted.

To ascertain the exact amount of mineral oil present in a mixture of fat and hydrocarbon oils, note the following experiments:

Prepare a caustic alcoholic solution of potash or soda of specific gravity 1.340 (68° Fahr.), and mix 10.15 c.c. of the solution with 25 grams—1 gram equals 15.43 grains—of the oil to be tested. Add 25 c.c. of distilled water and 5 c.c. of alcohol. Shake the mixture in a glass beaker or boiling tube and allow it to boil for about an hour, constantly stirring it with a glass rod all the time. All the oil will then be saponified. Put the mixture into a separating funnel, add some warm water and 25 c.c. of petroleum ether, shake well together for several minutes, and then allow the mixture to stand undisturbed until it separates into two layers. The mineral oil will be mixed with the petroleum ether in the upper layer, while the lower layer will consist of the soap made from the fatty oil; run off this and add clean water, shake up the mixture again and let it rest a second time. Pour off the aqueous layer. Repeat this operation until the aqueous layer runs off clear, then run the ethereal layer into a weighing glass, the weight of which while dry and clean has been ascertained, gently warm the mixture to drive off the ether by evaporation, and then weigh the oil which is left behind, the difference between the weight of the dry empty weighing bottle and that when it had the oil in will give the weight of the oil that has been obtained; this weight, multiplied by four, will give the percentage of mineral oil present in the mixture under examination.

As many readers may not be acquainted with the metric system of weights and measures, the following are the English equivalents of the above figures: 10 c.c. = 0.6102 cubic inches, or .1543 grains; 25 c.c. = 1.5255 cubic inches, or .3857 grains; 5 c.c. = 0.3051 cubic inches, or .0771 grains; 25 grams = 385.75 grains.

Action of Sulphuric Acid on Oils.—The action of sulphuric acid on oils affords two methods of differentiating oils, one by means of the color imparted to the mixture of oil and acid and the other by the temperature of the mixture.

The color test is one which is very easy to perform, but requires experience to be able accurately to distinguish the gradations of color of the mixture, because the slightest departure from the prescribed procedure brings a difference of tone. The test should be performed always under precisely the same conditions, so as to insure uniform results. Only in bright daylight can this color test be made. The operation is performed by putting fifteen to twenty drops of the oil to be tested into a clean, dry, white porcelain evaporating dish, and then let drop into the oil two drops of the acid, of concentrated strength, closely watching until the streaks of color that are formed in the oil as the acid unites among the oily particles becomes, after a short time, of a uniform tint, the color diffusing itself through the oil. In a minute or two stir the mixture with a glass rod and again watch the color. That given by vegetable oils are mere traces of yellow, brown and green. The colors exhibited by fish oils, turn off a purple or violet hue, the color imparted by animal oils turns red or redish-brown; while mineral—hydrocarbon—oils turn blackish-brown to a slight degree.

To make the test of value it should be a comparative one; that is, the experiment should be made many times, with samples of all the oils in the purest state possible, and the results tabulated, and these tables referred to when testing suspected samples. It is only by long practice and experience that the test can be accurately relied on to distinguish a mixture of several kinds of oil.

The temperature test is much more practical, and the way it is performed is this: Put 20 c.c. of the oil into a glass beaker, and stand a glass thermometer in the oil and note the temperature; then add 8 c.c. of strong sulphuric acid of specific gravity 1.845, and by the aid of a thermometer, using it as a stirrer, mix the oil and acid together by stirring, and continue stirring until the temperature ceases to rise. 20 c.c. = 1.2204 cubic inches; 8 c.c. = .48 cubic inches. Note the highest degree of temperature obtained by the mixture; then, by subtracting the temperature of the oil from the temperature of the mixture, the difference will be the increase of temperature caused by the action of the acid on the oil. Now, as the temperature obtained by the above experiment differs according to the nature of the oil used, this test affords a ready means of ascertaining what is the oil which is under examination then. The general increase of temperature by various oils is as follows:

11.0 deg. Fahr. Scotch shale oil.	67.6 tallow oil.
45.0 rosin oil.	79.2 olive oil.
54.0 petroleum lubricating oil.	97.2 castor oil.
57.6 neatsfoot oil.	104.4 rape oil (thickened).
63.0 rape oil.	117.0 cotton-seed oil.
66.0 sperm oil.	122.4 linseed oil.

To Test for the Presence of Free Acid in Oils.—Fatty oils, as they decompose, become rancid, owing to the chemical reactions that occur in them. This rancidity is brought about by the action of oxygen on the oils, whence they become decomposed into the fatty acid constituent and the base glycerine. Other oils that are not fatty oils exhibit traces of free acid. Now it is almost needless to say that such acid is injurious to the machinery on which such oils may be used. Every reader knows how a mere spot of water will cause a spot of rust to form. The rust is an oxide of iron which has been produced by the oxygen in the water uniting itself with the metal and oxidizing it. Everyone knows the erosive action of rust on iron, and how in time the metal will be eaten into holes. Now the action of an acid is much more energetic, and therefore a lubricating oil that contains acid is a most insidious enemy to the machinery, and it will eat into the delicate parts of the machinery that are out of sight or reach, and thereby set up a loosening or weakening of the parts of the machine where least expected or suspected. This free acid acts on copper or brass as well as on iron and steel after being in contact for some little time. The presence of free acid may be due to imperfect extractions of the oil, or it may be engendered by the reactive changes that occur in keeping the oil for some length of time, because incipient chemical changes are slowly but surely occurring, whereby rancidity or fatty oil acids are developed. As mineral—hydrocarbon—oils are free from the presence of oxygen as a constituent, they are generally free from the presence of free acid; but if such oils have been imperfectly washed there are traces of sulphuric acid likely to be present.

To Test for the Presence of Acid in Oils.—The only test which is trustworthy is to use a tincture of phenol phthalein, and render it alkaline with a little caustic soda, and then shake up the suspected oil with a little of the test reagent. The red color of the tincture will be discharged if acid be present in the oil. The proportions to add are as much phenol phthalein as will cover a shilling (quarter of a dollar) to 10 to 12 ounces of methylated spirit, then add sufficient of the solution of caustic soda to render the fluid perfectly of a reddish tinge. In shaking up a little of the mixture with the oil the presence of acid in the oil is at once shown by the reddish color disappearing.

A Quantitative Test for Free Acid in oil is easily made by the aid of the above reaction. The process is this: Mix 10 grams (154 grains)—by weight—of the oil with 10 c.c. of neutral methylated spirit or alcohol, stirring the whole time by mixing; then add 1 to 2 c.c. of the above phenol phthalein tincture, place the vessel under a burette, which is filled with a standard decinormal solution of caustic potash or soda; turn the tap of the burette—some burettes are closed with india-rubber tubing and a spring clip instead of a tap—and allow the alkaline solution to drop into the oil mixture. A burette tube graduated in c.c. is the best instrumen to use for measuring these quantities. Stir the oil constantly, and watch the moment when a permanent pink tinge remains as the alkaline solution.

drops in. The *rationale* of the process is this: When the alkaline solution reaches the oil mixture it produces a pink spot, but this pink color disappears on stirring the mixture so long as there is any acid in the oil mixture, but when all the oil is neutralized by the caustic alkaline solution the pink color of the spot is not effaced but remains permanent. When this occurs note the number of c.c. of the alkaline soluion that has been required to neutralize the acid in the oil, and for each c.c. of it 0.0282 of oleic acid has been neutralized; by multiplying the resultant number by 10 we get the percentage of acid that is present in the oil.

To Distinguish Mineral Acids from Fat Acids in Oil.—Use a solution of methyl orange. Mineral acids, such as sulphuric, will turn this solution pink; but fatty acids, such as oleic, palmic, etc., will not affect it.

Viscosity of Oils.—By viscosity of an oil is meant its semi-solid condition or body. A thin fluid like paraffin oil has but little body or cohesion, but flows readily, whereas one like castor oil is thick or viscid, and flows slowly. The viscosity is due to the cohesive and adhesive powers of the particles; that is, the particles of a viscid oil like castor oil cohere so well that they will not readily separate or flow freely, while the adhesive quality gives a viscid oil the power of sticking to a surface; the less adhesive power a fluid possesses the easier it flows off a surface. Now, to these qualities—cohesion and adhesion—is given the general term viscosity. It is one of the most valuable properties of a lubricating oil, because the cohesive power permits the oil being thinned by the pressure of heavy bearing, while the adhesive quality prevents oil flowing away from the surface too freely. Now, although viscosity is the chief value of a lubricating oil, the value of such oil must not be gaged by the amount of viscosity of an oil, because a proper application of lubricants consists in using those which are most suited for the special parts of a machine; thus, a bearing like a revolving shaft requires a thick or viscid lubrication so that the particles of oil shall not be too readily pushed asunder by the weight of the shafting, and so thin the oil until it forsakes the bearings altogether. A thinly fluid oil would be out of place here, whereas, if it be a quickly revolving spindle that requires lubricating, a thick oil would be out of place, a thin one being the most appropriate. The proper use of lubricants consists in the selection of an oil most suited for the work the lubricated part has to perform, and it is for this reason that the knowledge of the exact viscosity of an oil should be familiar to the engineer. Even in the case of heavy pressure the viscosity must not be too great, otherwise the oil will fail to push its way between the shaftings and bearings, with the result that they will not be lubricated.

A simple and ready means of testing the viscosity of an oil is this: Take a narrow tube a few inches long, one end of which is drawn to a point, but has a small opening in it; fill this up to a certain mark, mix the oil, and note how many seconds it takes for the oil to drop out.

A series of comparative tests will thus show the comparative viscosities. This test, however, is not a very accurate one, as the viscosity or fluidity of an oil varies according to the temperature at which the test is made. The higher the temperature the thinner the body of the oil becomes, and consequently the quicker it will flow out; but if a uniform temperature, such as 70°, 100°, 120°, 180° and 212° Fahr., be adopted, the above simple test will be found sufficiently accurate for most purposes in a workshop. There are several instruments constructed for the purpose of more accurately determining the viscosity of the oil; but unfortunately, owing to the viscosity varying according to the temperature, and the specific gravity of these oils not being the same, such instruments cannot be made to give absolutely correct results.

The following table shows the relative viscosities of various oils at 70° Fahr., and at the boiling point of water, 212° Fahr. Rape oil at 70° Fahr. = 100 is taken as the standard:

70° Fahr.	212° Fahr.		Sp. Gr.
20	11	Scotch mineral oil	865
36	10.5	American mineral oil	885
45	12	Scotch mineral oil	885
63	13.5	Scotch mineral oil	890
66	12	Russian mineral oil	896
85	12	American mineral oil	910
90	12.5	American mineral oil	915
122	14	Russian mineral oil	908
127	17	American mineral oil	920
221	12	Rosin oil	—
236	16	Russian mineral oil	910
245	17	Medium machinery oil	—
316	17	Russian mineral oil	914
1,300	90	Summer dark machinery	—
1,860	43	Cylinder oil	—

It is noticeable that while there is a very great difference of viscosity at 70° Fahr., there is a very small difference between any of them at 212° Fahr.

Flash Point Test.—Is of great value for determining the safety of an oil for lubricating purposes, but it is one which requires special apparatus, and even the accuracy of the results depends on the perfect means the operator has of heating the oil to be tested, because if heated too rapidly the flash point may be many degrees lower than when the oil is carefully and uniformly heated, consequently this test is not satisfactorily undertaken by the operator. All mineral oils when heated to a certain degree evolve vapor which is inflammable. The temperature at which the vapor can be ignited by applying a naked flame to it is called the flash point. Now it requires but a moment's reflection to show how serious might be the results if a lubricating oil became heated higher than its flash point, and so be turned into vapor, because such vapor would fill the air of the room or workshop, and on coming in contact with a naked flame it would ignite with explosive violence. The lowest flashing point of a lubricating oil is 330° Fahr. for ordinary purposes, 350° Fahr. for cotton mills and places where there are inflammable materials, while for cylinder oils 500° Fahr. is the lowest flashing point that is generally safe. The following table shows the flashing point of hydrocarbon oils used as lubricants:

Deg. Fahr.		Sp. Gr.
318	Scotch shale oil	865
320	Rosin oil	985
320	Pale Russian petroleum oil—residuum	910
330	Scotch shale oil	875
348	Russian petroleum oil—pale	896
353	Scotch shale oil	885
376	Scotch shale oil	890
384	Russian petroleum oil	908
390	Pale Russian petroleum oil	914
392	American petroleum oil—pale	903
422	American petroleum oil—pale	915
428	American petroleum oil—pale	920
462	American petroleum oil—cylinder	—
528	American petroleum oil—cylinder	—

Evaporating Test.—The rate of evaporation of an oil when exposed to air is a test which is easily carried out. Thus, take a concave watch glass, and then put a small quantity of oil into it and weigh again; then put the watch glass and oil into an oven that has a temperature of 212° Fahr., and maintain that heat for twenty-four hours. When taken out, reweigh the watch glass and remainder of oil. The loss in weight should not be more than 0.25 to 0.5 per cent.; if more than 1 per cent. is lost, the oil is one that is suspicious and best avoided.

For cylinder oils the temperature of the oven should be 360° Fahr., and the heat maintained for five hours only. Chemical tests afford means of determining the nature of the oil, but they can be only successfully undertaken by a person possessing chemical knowledge and experience in manipulating chemical apparatus; therefore such tests do not come within the scope of this article, which is solely intended to put operators in possession of how to test in a general way the oils they use. If more elaborate tests are required it should be done by an expert analyst in oils.

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The North Pole is said to have got out of place, and astronomers are enjoying a discussion about it. Any serious displacement should make the pole more difficult of discovery than ever.

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The New York "Journal of Commerce" has made a canvass of the United States industries which have been organized into trusts, pools, etc. It discloses the fact that 200 of such organizations exist with a total of capital, stock and bonds amounting to $3,662,000,000. This capitalization equals 56 per cent. of the aggregate capital of all the manufacturers of the United States, according to the census of 1890.

Some Notes of Travel.

About two years ago I sent you a description of a visit which I made to Ireland, when I had the opportunity of going upon the Fastnet Rock, that little dot in the ocean which the traveler across the Atlantic sees when he nears Queenstown. Since my last visit there has been commenced the foundation for a new lighthouse of granite to replace the iron structure which now stands at the top of the rock. The new house will stand upon a lower part of the rock full in the force of the westerly gales, and its construction must necessarily be of the best, for the lantern of the present house, though 160 feet above sea level is often, in winter, buried in green water. By means of a terrace cut round the north side of the rock, a narrow gage tramway has been laid to afford a means of communication between the place of landing and the new site. The rails are spiked down into the solid rock and the space filled up solid in cement or granite all over the width of the terrace, so that only a groove for the wheel flanges remains. I spent no fewer than twelve days on the rock, and as my business there was such as could not be pursued except at low tide, and even then only when we were tied fast by a rope to secure a holdfast, I had a considerable amount of spare time to observe the many passing steamers, the few accidental land birds which seem to be attracted by the light and perish on the rock, and the flight of sea birds, a subject I have always taken under observation when possible. Continually around the rock are numerous gulls of various species. Herring gulls, the common gull, the black backed gull, gannets, cormorants, and other birds. It was somewhere stated recently that the flight of birds in respect of soaring had been explained by Lord Kelvin to be due to the fact that the soaring birds take advantage of upward currents of air to enable them to soar. Winds owe their formation, it is true, to upward movements, but there must be corresponding down flows somewhere to make a balance. Without putting my opinion against that of so learned a man as Lord Kelvin, I think I may say that it is difficult to accept his explanation as sufficient to account for what one may observe. Even with a steady wind the gulls appear capable of soaring with fixed pinions on any side of the rock. I could understand the obstruction of the rock to cause an up current on the windward side, but not all round and not at any very great distance from the rock. Yet neither distance nor windward or leeward positions seemed to exercise any hindrance to the flight, and I cannot but think that birds soar in some way because they are able to trim their sails to the breeze, and are able to avoid making leeway.

What an immense contrast there is between the cross channel steamers of to-day and those which I remember of over twenty years ago, when first I visited Ireland! In those days there were four paddle boats with very large paddle wheels driven by the class of engine which revolved occasionally. I suppose the steam pressure at that time was about 30 pounds, and boilers were curiously shaped to fit the cross section of a ship without any special regard to the change of form they would undergo if more heavily stressed.

As the boats had only a shallow draft there was not much room between the keel and the paddle shaft for long rods, even though the paddle shaft lay across the promenade deck, and, if I remember rightly, was covered in by a casing over which two little stairs were placed for passengers by which to get over the shaft. There were two cylinders and no piston rods. The connecting rod took hold of the piston, as in a gas engine, and worked through a huge oval trunk so that the crank pin came down nearly into the cylinder at the down stroke. Sixteen miles per hour was looked on as something quick in those days. To-day the paddle has gone almost out, and the vessels employed on the Dublin-Holyhead route are of screw type, the latest with twin screws. One of the latest has two four-cylinder, triple expansion engines with piston valves, and two low pressure cylinders, carries steam of 160 pounds, and with 200 or so revolutions of her engines travels 25 miles or even 25 knots per hour. There is forced draft, by means of fans blowing into a closed stokehold, entrance to which is by an air lock. In the passages leading to the fan chamber it is difficult to restrain from a run, so strong is the torrent of air rushing to the two large fans which are driven by small high speed inclosed engines, and pour an immense volume of air down into the stokeholds. These are cool and comfortable, and very different from what I remember the old-time boats. The engine room and all passages are also kept cool by the powerful indraft of the fans. There is ample working space in the shaft tunnel, which holds both screw shafts and shows how the vessel is shaped to allow free flow of water to the propellers. Though everything on a modern steamer may be at high pressure, the duties are better in all respects than they were in the old days Compare the ash hoists, for example. In an old-fashioned steamer the ashes are loaded into a tub which is wound upon an air trunk of a small engine, and the ashes are put overboard. Winding ashes is a dirty, tedious job, deservedly hated. In a modern steamer, with forced draft and a closed stokehold, the ash and clinker are simply shoveled onto a coarse-barred grating, and they disappear. If a piece of clinker is too large to pass the wide grating a blow mashes it through, and away it goes up a pipe and into the sea. The air blast does it all, and quickly blows overboard everything that is shoveled upon the ash grating. Perhaps it may interest some of the older readers of "The Machinist" to learn that I have recently met Mr. Joshua Rose, who has written so much on mechanical subjects in "The Machinist." We have lived not far apart for several years, within easy reach of each other and have only just found each other out. W. H. Booth.

London.

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Two-Year Courses at Pratt Institute.

We have received from Mr. Arthur L. Williston, director of the Science and Technology Department, Pratt Institute, Brooklyn, a circular containing particulars regarding that institution's two-year courses in drawing and machine design and applied electricity. The drawing course covers projection, problems in mechanism, intersection or surfaces, finishing up with problems in construction and machine design. This is supplemented by actual practice in shop work, study of the process of iron and steel production, strength of materials, etc. The course in applied electricity includes the study of physics, heat, sound, etc., which study is followed by work in the laboratory. Entrance examination for these courses for the next term will be held September 21, 1898.

These courses are not intended to train expert engineers as is the case in the more advanced engineering schools in which the work is necessarily of such a theoretical nature as to involve knowledge of higher mathematics, so that it is found necessary to spend the first two years on top of a high school education previous to taking up the technical work which follows. Nevertheless the aim of these courses is to give students such a training in the practice and theory of electrical and mechanical work as to prepare them later to fill responsible positions in the mechanical world. All necessary information regarding these courses can be obtained by addressing the secretary of the Institute.

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At Gawler, in South Australia, there was recently celebrated the jubilee of a pioneer machine man, James Martin, of the firm of Martin & Co. He started the Phœnix Foundry at the above place in 1847 to make bullock drags. He made his first lathe-bed and benches from a tree cut on the site. He was soon making agricultural implements and finally got to locomotives. The company now has 700 employés and a capital of $750,000.

The Australian Market for American Machinery.

A letter received by the Philadelphia Commercial Museums from a sugar refining company in Cardalba, Queensland, Australia, says that sugar machinery used in the colony of Queensland is mostly from Glasgow; that used in Honolulu, Hawaii, comes from America and is spoken of highly, and it is believed if introduced in the Queensland factories would meet with good demand. Thus far, however, it is stated, American makers have not advertised in Queensland, and the cost of freight and other particulars are unknown.

The tramway system used on sugar plantations is the portable 2-feet gage, with 16-pound rails, and for permanent way there is a great demand for 30-pound rails and some locomotives to suit the cane fields. Locomotives made by French, English and German firms are the only three kinds now in use in Queensland's cane fields. Cane lifts, field implements, clarifiers and anything new regarding machinery or labor-saving appliances will always meet ready customers.—Ledger, Philadelphia.

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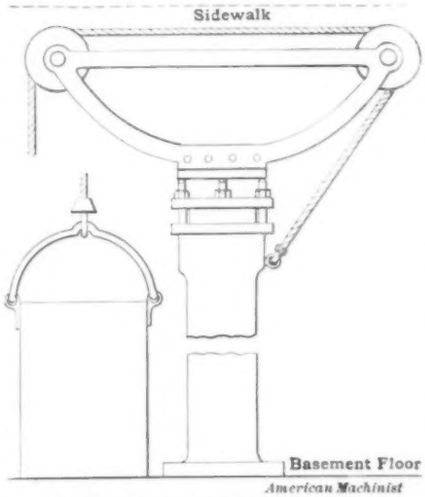
A Hydraulic Hoist for Ashes.

The accompanying sketch, which requires little explanation, shows a device employed for raising ashes from the basement of a building in this city to a cart in the street. When not in use everything is below the sidewalk, as shown. The cover being removed and the bucket hooked by the cable the ram rises as the city water pressure is turned on, the bucket rising twice as fast as the ram, so that when the latter has risen about 8 feet the bucket is high enough to dump into a cart, and the ram is turned half way around to bring the bucket to the cart standing at the curbstone. Hitching the rope to the side of the column makes it easy to swing the load around. The device suggests various applications. The rise of the bucket may be made threefold, fourfold or more by a suitable arrangement of sheaves and by attaching the end either to the standing cylinder, as shown, or to the sheave carrier above, and compressed air may of course be used, where available, instead of water.



A HYDRAULIC HOIST FOR ASHES.

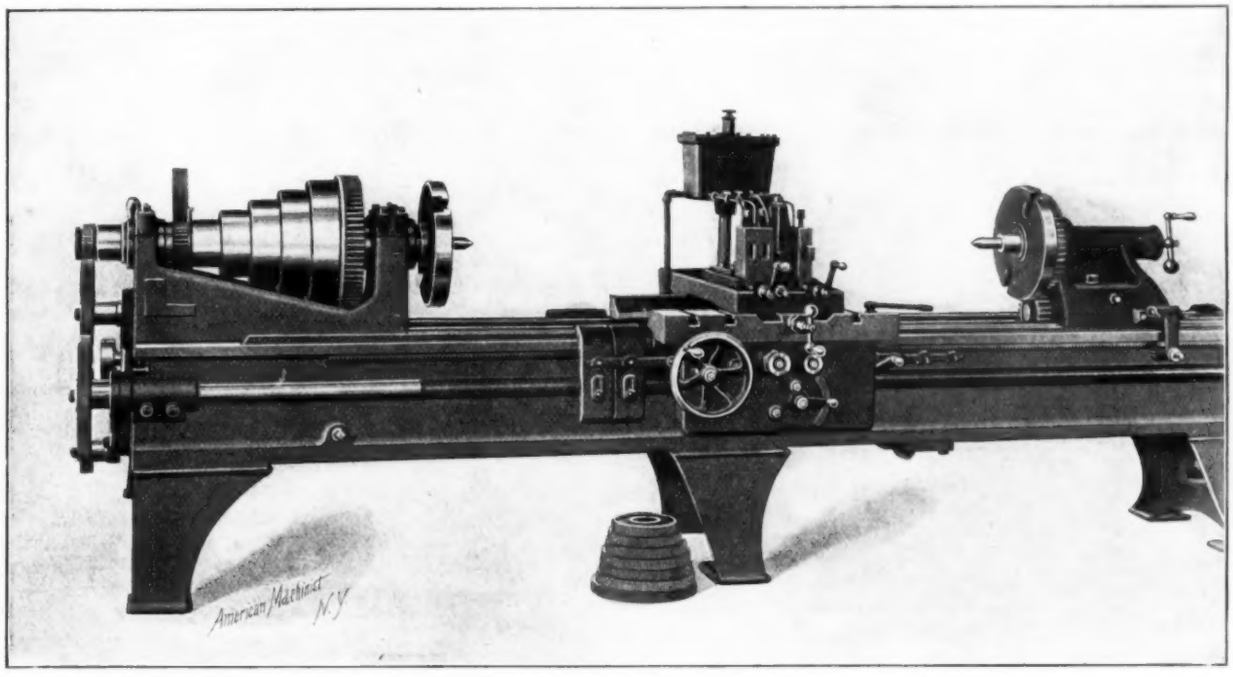
A Shafting Lathe.

The shafting lathe of which we give engravings is in its general features similar to others that have preceded it, as in fact a shafting lathe probably must always be, but it has some features that we believe are new for such lathes. The lathe was designed and built by the Springfield Machine Tool Company, of Springfield, Ohio, on an order from Germany, and is intended to be used both for general lathe work and for turning shafting, particular attention having been given to so arranging things as to enable all necessary changes to be readily made from one kind of work to the other.

The photograph shows only a part of the length, the lathe being designed for shafts up to 30 feet long and 5 inches in diameter. It swings 24 inches over the shears.

The lathe feeds either by a friction feed or by the lead screw as usual, and passing through the bed below and midway between the shears is the usual splined shaft from which the footstock faceplate is driven in the manner common to shafting lathes, but in this case this shaft is driven by an intermediate gear under the main spindle gear, which intermediate is arranged to be thrown into or out of engagement by means of a worm-wheel sector, as shown at the left of Fig. 2 and in Fig. 3.

The special carriage rest for shafting slides into place on the saddle when the compound rest is removed, and this shafting rest carries with it the pump and tanks for lubricant as shown in Fig. 4, the pump being driven by means of a



24-INCH SHAFTING LATHE.

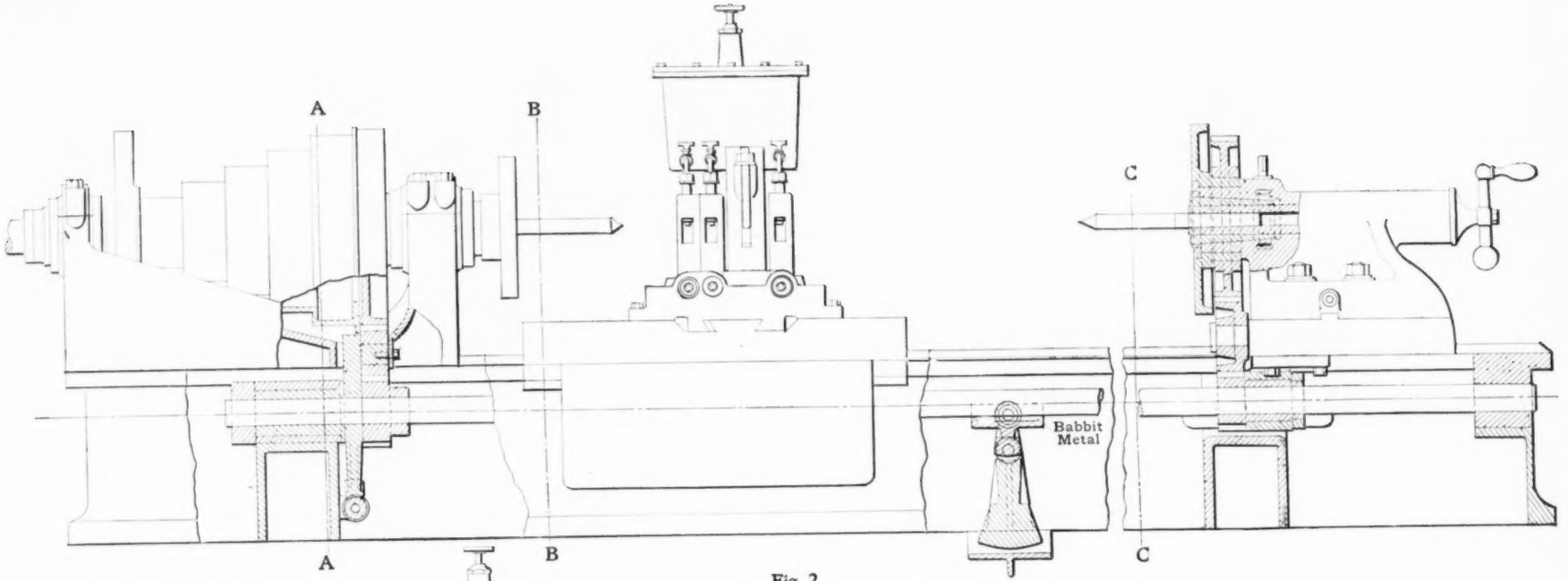


Fig. 2

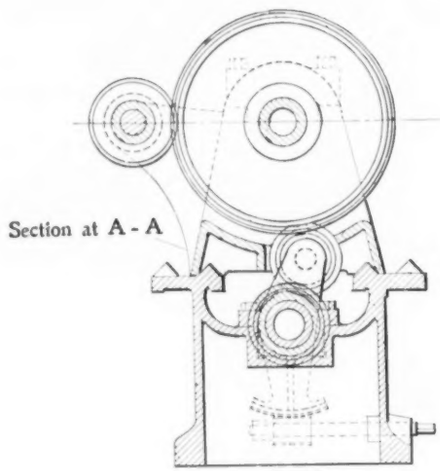


Fig. 3

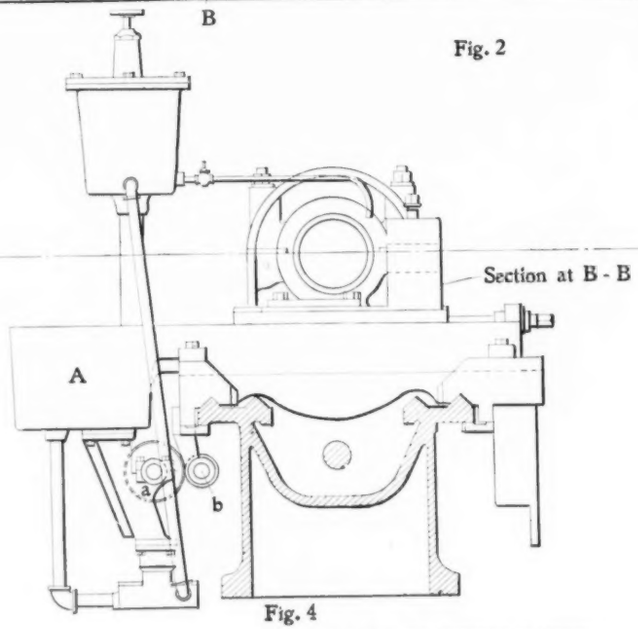


Fig. 4

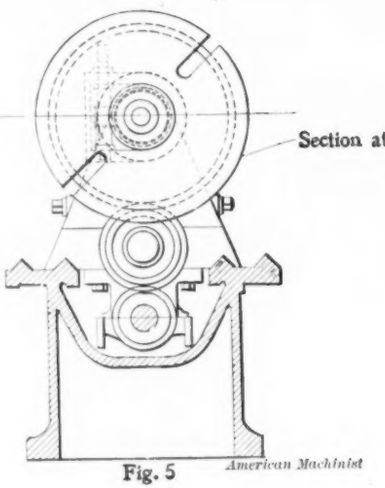


Fig. 5 *American Machinist*

24-INCH SHAFTING LATHE.

spur wheel *a*, which engages with a pinion sliding upon a shaft *b*, which extends the entire length of the lathe at the back. Arrangements are made for collecting all soda water or other lubricant on the rest and returning it to the lower tank *A*, from which it flows by gravity to the pump and is returned to the upper tank. This upper tank is closed and provided with an adjustable relief valve, by means of which any desired pressure may be maintained and a copious supply of lubricant insured. The pump is a duplex, single-acting, plunger.

The shaft being turned passes through a follow-rest, as shown, in front of which are two tools supported upon separately adjustable rests, the finishing tool being at the rear of the rest and all of them in front of the lathe nearest the operator.

The partial section at the right of Fig. 2 and in Fig. 5 shows the arrangement at the footstock end. The face-plate has a bearing on a projection of the barrel of the footstock, and is secured by a threaded ring, as shown. When the 'athe is to be used for some time on general work, or when for any reason it is desired to use it without this face-plate and gear, the removal of the threaded ring referred to permits the plate to be slipped off, and when this is done there is the projecting barrel so strongly recommended by Professor Sweet, and which is almost universal in British practice. At such time, to prevent accidental injury to the bearing on the barrel and to give a neat appearance, a collar slips over the bearing and is secured in place. It will be noticed also by reference to Figs. 2 and 5 that the device for clamping the tail-spindle has been especially designed for its place, and consists of an externally tapered sleeve, which is split and the inner end threaded to receive a ring which is cut with teeth to engage a worm, as shown. Thus the spindle is not only clamped securely as near the work as possible, but is also held truly central. It may be well to explain to those who are not acquainted with shafting lathes that this lathe is intended to drive the shaft at first in the ordinary manner by a dog at the headstock, and that as the cut approaches this dog it is removed, and a dog applied at the other end, which is driven by the footstock face-plate and enables the cut to proceed to the end of the shaft. The long centers used are a necessity, as they must reach through the bushing in the rest, which bushing is of course mainly depended upon to support the shaft during the cut, and is made of cast iron to fit the shaft, thus securing a reliable and satisfactory support.

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Following Up Correspondence.

I am personally acquainted with a certain manufacturer who is very careful in keeping track of his correspondence. Every letter that goes out of the office is recorded in a book in addition to the regular carbon copy which is preserved. Every letter that comes into the office is recorded in this same book and checked up against the previous correspondence which may have been sent out. If a letter goes out on any subject and no reply is received within ten days, a second letter is sent, politely worded and endeavoring to find out if the first letter reached its destination, and covered the points which the correspondent wished to know.

If no reply is received to this second letter within twenty days the manufacturer writes again to express a hope that he has not been overlooked in placing the order. This letter is accompanied by a stamped and addressed envelope, in which the party written to can answer if so disposed. It is usually the case that some kind of a reply is received by this time. The reply gives the manufacturer a chance to correct any misunderstanding or oversight which may have occurred through his not fully understanding the needs of his possible customer, and always leaves him in a position to correspond, at some future day, with his prospective customer.

The manufacturer tells me that, through this careful system of following up correspondence it has been found that probably 25 per cent. of the orders received would never have been secured had only one letter been written.—Charles F. Jones, in Printer's Ink.

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Letters from Practical Men.

An Experiment in Boiler Settings.

Editor American Machinist:

One of the sources of frequent trouble, annoyance, delay and expense in operating steam boilers is the liability of the fire bricks to burn away, crumble to pieces and fall out of their places. This often necessitates a stoppage, cooling off boilers, replacing fire bricks, a mason's bill to pay, much annoyance and oftimes considerable loss. This is particularly the case with the fire bricks at each side of the fire doors, which support the arch plates, as shown in horizontal section at *A*, Fig. 1. The corners at *A A* are especially exposed to the action of the heat, and are usually burned off in a rounded, unsightly form and frequently loosened so as to drop out.

Another point that has doubtless occurred to many firemen is, why is a square corner left in the fire-box at each side, as at *B B*? This space is of very little use in generating heat, and being difficult to get at with ordinary fire irons is generally encumbered with ashes and cinders.

These two points led to the adoption of the arrangement shown in Fig. 2. In this arrangement the fire bricks on the two sides of the fire door were replaced by cast iron plates about 1¼ inches in thickness and high enough to allow the ends of the arch plate to rest upon them. The form of the plates was as shown at *C C*, Fig. 2, the front end fitting in behind the inwardly projecting flange of the boiler front which surrounds the fire door at each side, and their rear ends resting against the fire brick lining at the sides of the fire box, being inclined at an angle of about 45 degrees thereto. The plates are perforated with numerous cored holes about ½ inch diameter, placed 1½ inches apart, each way over the entire surface. The weight of the arch plate resting on them holds them firmly in place.

The plates have remained in place one and a half years and are practically as good as ever, although one arch plate was burned out in the meantime and another one nearly so. The disagreeable square corner spaces *D D* have been eliminated, much to the convenience of the fireman, and, as far as can be ascertained, no necessary grate area has been lost. During the year and a half no mason's bill has been contracted, a few bricks and some fire clay supplied to a handy fireman or engineer being all that was found necessary in putting in the plates and keeping them in order. It was feared that the plates would warp from the heat and so be rendered useless, but they have not done so to any appreciable extent. The spaces *D D* are left open, or preferably filled with loose brickbats or pieces of the same, to prevent strong upward currents of cold air.

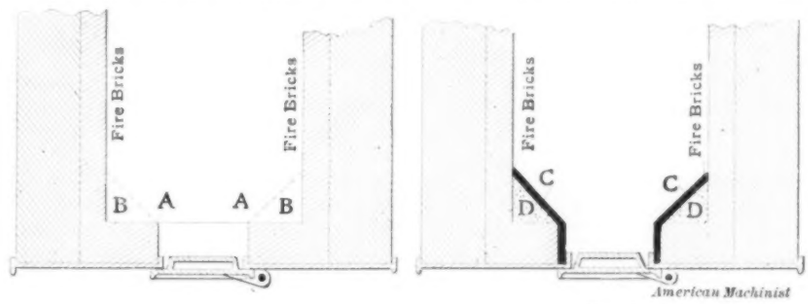

Fig. 2

AN EXPERIMENT IN BOILER SETTING.

The plan is recommended to those having the care or paying the bills of steam

generating plants who have been troubled in a similar way, and who desire to increase the conveniences of firing and to reduce the expenses of keeping the fire box linings in good condition.

OSCAR E. PERRIGO.

New Haven, Conn.

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Shop Proprietors and General Managers.

Editor American Machinist:

I have lately had quite a scare. I have got over it enough to be able to talk about it a little, but my mind is not yet quite at ease. My friends generally know that I have considerable affection for the small shop. I do not love the small shop exclusively, but still it is probably nearer my heart than any other. I always slip into the little shop when I come near one, and it is rare that I don't find something noticeable and interesting. What I have learned of things mechanical I have picked up mostly in the small shops, and I hope, or, rather, I did hope, to keep on getting more in the same way.

My hopes have been cracked, if not shattered, by the announcement by one of the philosophers of the day that the small shop is soon to be wiped out of existence. It has had many difficulties and trials to fight against all along, but it is a new and a hitherto unheard of danger which now threatens it. The salaries which are paid to the managers and superintendents of the large manufacturing corporations are now so big—and they say they are gettting bigger—that a fellow who has a small shop, even if he is running it successfully, is losing money right along until he shuts up the little shop and accepts the high salaried position. I have friends in small shops in different parts of the country, and they are all now in danger of being gobbled up. The feeling that the idea provokes is not a comfortable one.

The more I think about it, however, the more I don't believe there is anything in it. The big shops are not plenty enough, anyway, to make much trouble of this kind. Each big shop might of course swallow any number of the little shops, but only one of the fellows that own and run them. The big shops don't want the little proprietors, anyway. The man who has been running the little shop is usually the last man to be chosen to put in charge of the big shop, and very properly so. The ways of the little shop would not fit the big shop, and the ways of the big shop would ruin the little shop. The little shop man is still likely enough to become the manager of the big shop, but it must be as it always has been by the growth of the little shop, and the man with it, into the big shop.

But it is not merely the difference in the ways of the little shop as compared with those of the big shop—the difference between the retail and the wholesale ways of doing things—that unfits the proprietor of the one from becoming immediately the successful manager of the other. The difference in the attitude of the man toward his work is really the vital thing. And in this case the difference is great. The difference between the possible profits of the little shop and the salary which the big corporation can offer does not even approximately represent it. You can't hire the whole man to work as he can work for himself. He may be honest enough, but his full interest will not be enlisted. Even in the operation of the civil law the truth is not established, justice is not accomplished, by the testimony of disinterested witnesses. They do not bring out all the truth. It is only when those most keenly interested on each side have had their say, and have by their one-sided zeal brought out all the strength and the weakness of each side, that all is known and an enduring verdict can be rendered. So we may be sure that when the whole man works it will be because he works for himself, and he will still have a winning chance.

There are of course large lines of business which may be operated by salaried officers as well perhaps as in any other way, because there are established standards of product or performance to which they may be held. We may know precisely what a flour mill or a brewery should turn out, but who knows what should be the output of a machine works, and especially who can say what improvements both in product and in cost of production may not be possible of development in the near future? There is no fixing the one or the other, because the zealous and sanguine self-seeking pioneers of the little shops are all the while making new standards, and we may be very sure that they will continue to do so. There are advertisers in the columns of the "American Machinist" who are all the while upsetting all established precedents as to rules of performance, and in the reading columns also flows a stream of suggestion that washes away all the old landmarks.

TECUMSEH SWIFT.

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Driving Twist Drills.

Editor American Machinist:

The suggestions of Mr. Wright regarding drill chucks are quite correct for that mode of driving, but the mode itself is not correct.

It has been recommended by Mr. Coleman Sellers years ago to use a feather key in the socket and a groove in the shank of the drill. When this is done properly it makes an excellent job, and no stress within the strength of the drill can tear it loose. The Morse taper is everything that can be desired, both for the drills and sockets for the drill spindles. All the drills in a shop ought to be fitted to one size and taper, and the spindles as well as the sockets ought to have feather keys. An easy way to fit these feather keys is to drill a hole in the socket close to and parallel with the taper side of the socket, then cut one-quarter of the circumference of the hole out open into the socket, make a parallel key of square tool steel with three corners filed off, leaving the remaining corner to project into the socket. Drive this key in tight to a depth nearly the length of the taper. Reduce the sharp corner to a small round, and mill the drill shanks to fit over it loosely, and you have something that will stand at very little expense.

All sockets of the same size having the same size feather, the outfit will be interchangeable indefinitely. This is not new, but good. The firm I am connected with has followed the plan for fifteen years with entire satisfaction. The flat ended drill, even with Mr. Wright's improvement, will not stand heavy work, but the feather key will stand everything.

The cost of milling (or shaping) the shanks is saved a hundred times over in the life of every drill compared to the old way. It may be preferable to make the feather key somewhat oval to project a little farther into the socket than the square steel would do, but that is a detail in which everyone will choose for himself.

C. W. CRAWFORD.

Brazil, Ind.

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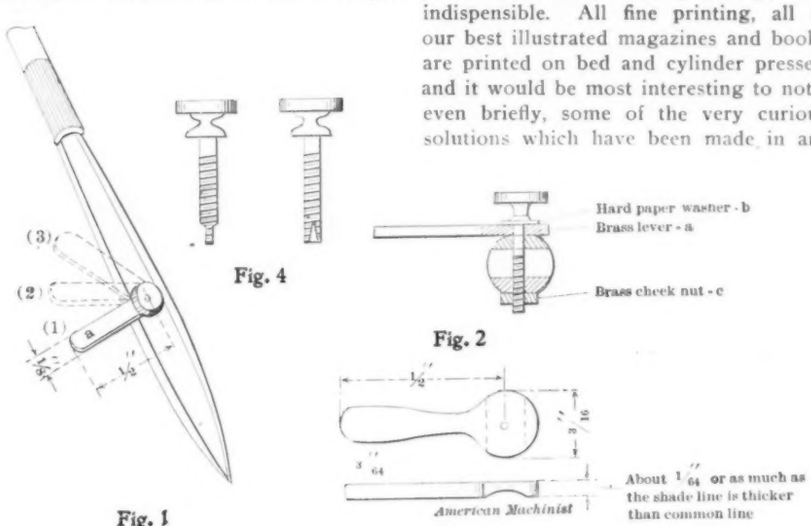
A Pen Adjustment for Shade Lines.

Editor American Machinist:

The accompanying sketches show a little device which I have used for several years with much saving of annoyance and labor. Of its originality there is nothing to be said, except that I have not seen it elsewhere. The device is readily made and applied to any ordinary lining pen, only requiring a little piece of sheet brass and about two hours' work. The general appearance of the pen when finished is as shown in Fig. 1. The lever *a* is attached under the head of the adjusting screw so that when it is in the position shown by the full lines the pen is set for a heavy line, and light or still lighter lines are obtained at once by shifting the lever to positions 2 and 3. In use the pen is held as usual between the thumb and forefinger, while the second finger naturally rests on the end of the lever, which can be moved to "heavy" or "light" position instantly, according to the line to be drawn. When set the pen stays as it is and does not need to be carefully pinched until the light line (or heavy) is finished. Of course, if many lines of the same kind are to be drawn successively it remains set for all.

The parts to be made are the lever *a* and nut *c*. The lever *a* is as shown in Fig. 3. The hole is large enough to slip over the adjusting screw, and the con-

cave notch filed across the under side of the lever is to fit the curve of the top fork of the pen. If more than two thicknesses of line are wanted, this notch should be filed wider, so that a longer movement of lever is required to force the nibs together.



A QUICK PEN ADJUSTMENT FOR SHADE LINES.

The adjusting screw must be held while the lever turns, which requires the check nut *c*, Fig. 2. To make this, cut it out of the sheet brass, drill the proper tap hole and tap it out with the adjusting screw itself. File the point of the screw as shown in Fig. 4 and it will tap the brass easily with a pair of pliers and a vise to hold the pieces.

This may not be as satisfactory to everyone as it is to me, but I think it worth a trial, especially as one does not have to buy a new pen. My own experience is that I never use my other lining pen at all. WALTER FERRIS.

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Originating the Hoe Rack.

BY JOHN RANDOL.

As mentioned in a previous article on the origination of the Robert Hoe & Co.'s dividing wheel, a correctly spaced rack is an essential member of a large and very important class of printing presses, known as the "Bed and Cylinder" type, in which the paper is secured to a revolving cylinder and pressed against the inked form of printing types carried under the cylinder on a flat platen or "bed." The general scheme of the bed and cylinder press is one of elegant simplicity and mechanical suitability, inasmuch as we can produce both cylinders and flat surfaces of cast iron which are nearly true without very great cost. In operative practice, however, the bed and cylinder press develops some of the most awkward characteristics imaginable, and the difficulties of this form of press increase so rapidly as the dimensions and speed are increased that a limit is soon reached which cannot be much exceeded and forbids the employment of this form of printing machine for some of the largest classes of work altogether. But within its limits the bed and cylinder press is indispensible. All fine printing, all of our best illustrated magazines and books are printed on bed and cylinder presses, and it would be most interesting to note, even briefly, some of the very curious solutions which have been made in answer to the complicated and peculiar problems which the bed and cylinder press involves did space permit. The scope of this article, however, demands the notice of but a single one of the many extremely perplexing requirements of the machine. It is evident that the bed and cylinder must move exactly together while the paper on the cylinder touches the type on the bed, because if there is any slip or difference in surface velocity of travel the result will be a "slur" or blurring of the print at the point where the surface speeds vary. Again, it is evident that the total working travels of the bed and cylinder must be exactly alike and made in exactly the same time, or else the result will be a "slur" of the last two or three lines printed on the page where the bed and cylinder begin to free themselves of the heavy friction of the "impression." Hence, if the total travel of the press bed and the cylinder vary by only a very small fraction of an inch in the total working travel of, say, 36 inches, the result is imperfect work, since there is no other place where the eye so quickly detects any blur or misplacement as on a printed sheet.

This necessary coincidence of bed and cylinder travel demands in practice a rack which is not only evenly spaced throughout its whole length, but which is exactly to pitch in inches; that is to say, which has a pitch, or, centre to centre, tooth distance of some exactly definable part of an inch, because a bastard rack would introduce an endless succession of dependant fractional dimensions not to be endured.

For a long time the Hoe racks were cut on a short Whitworth rack cutter, in which the rack in process of cutting was moved by a screw. This machine is still in use, and is believed to have a lead screw of unusual approximation to accuracy in length, but the screw is short, which made it necessary to move the bed racks along in the course of cutting, and, as is well known, such "moving along" is a very frequent source of error, although it is often done.

Finally it was decided by the Hoe management that the rack question must be settled for good and all by the construction of an accurate rack cutter long enough to cut the largest racks required without moving them in the machine, and, after a careful investigation of the best screws in evidence, it was decided not to depend on a screw for spacing the rack blank, but to space with a stationary rack operated upon by a long tangent screw or worm engaging the rack teeth. It is well known to those who have made a study of screw cutting that it is next to impossible to produce a screw which shall have a fixed number of turns in a fixed length, while if an accurate length measure can be obtained, sufficient labor and care can produce a rack which will have no measurable variations from this length measure. Two steel length measures or scales were therefore procured, 15 feet long, graduated in half inches on bars ⅝x1 inch. One of these was made by Brown & Sharpe and the other by an establishment of instrument makers claiming to be able to execute length graduations with only inappreciable variations from accuracy. The cost of these two 15 foot scales is not given, but it must have been something respectable, as the Hoe order was open, and simply called for a scale accurately divided in half inches exactly 15 feet long—an order much easier written than filled.

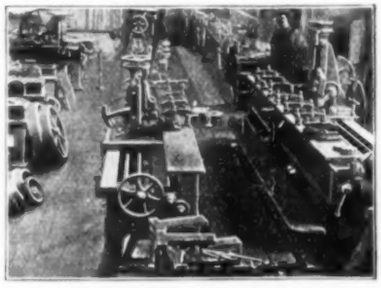

FIG. 1—GENERAL VIEW OF THE HOE RACK CUTTERS.

These scales were given to Mr. Edward A. Collins, one of the Hoe tool makers who had previously shown evidence of ability in original work, and he began his long task by a careful comparison of the two 15 foot scales. Neither of them was without discernible errors, but the Brown & Sharpe scale was by far the better of the two, and the Hoe rack corresponds in length to that scale. The exact length of this 15 foot scale is not known, and, of course, never will be

known, but it is so nearly 15 feet that the Hoe racks are considered standard, and when difficulties in rack and gear wheel work occur the wheel is held to be faulty.

The Hoe rack cutting machines are so lighted and situated as to make a satisfactory photograph impossible. The three photographic pictures given will, however, convey a general idea of their form,

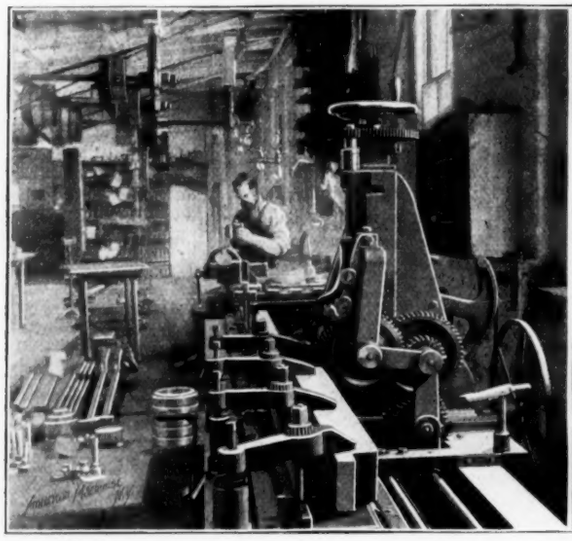

FIG. 2—HOE RACK CUTTER SHOWING LINKED GEAR TRAIN FOR DRIVING CUTTER SPINDLE.

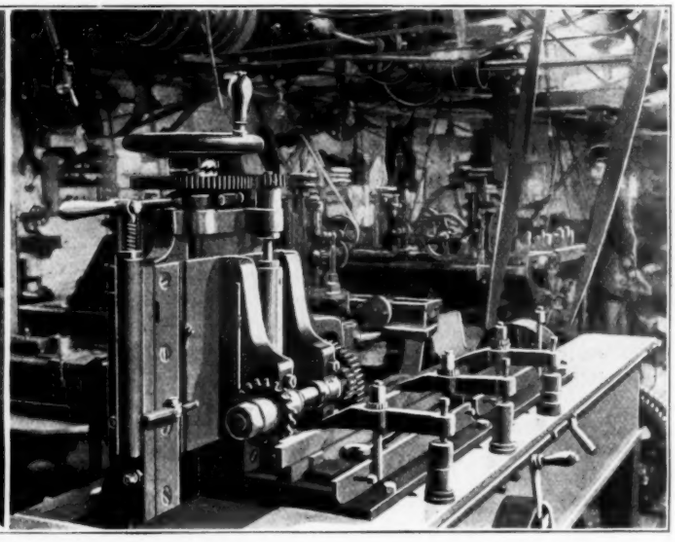

FIG. 3—HOE RACK CUTTER, FIXTURE AND CLAMPS FOR HOLDING BLANKS.

which is that of a long stationary bed, to which the work is secured, and a traveling bracket, moved by a tangent worm 12 inches long, engaging the teeth of the vertical spacing rack, 2 inches face, ½ inch pitch, which is secured to the inside of the frame under a ledge, and is not visible in the photographic illustrations. A side and an end view of this rack and tangent screw are given in Fig. 5. Some nice points of construction are the cutting of a worm of uniform angle, and the determination of the angle of inclination of the rack teeth.

The worm and the change gears for moving it are carried by the traveling bracket, so that the connection between the rack and the bracket is of the simplest and most direct description; the beds are abundantly heavy, and the whole conception and design show an excellent adaptation of means to ends. The cutter feed is semi-automatic, including a bottom knock-off, which stops the cutter feed when the space is cut; the attendant then lifts the cutter slide, turns the tangent worm for the spacing of the next tooth, and throws the feed into action. The rack blanks are held by clamps on long fixtures bolted to the flat elevated work seat of the bed, all as pretty well shown in Fig. 3.

The first of these two machines was built before the original rack was cut, and the rack was cut on its own machine —not so very quickly, it taking thirteen weeks to merely cut the 264 teeth in the original racks, 11 feet long and ½ inch pitch. There were two of these racks cut at once, as the two machines were contemplated from the first.

Mr. Collins, the tool maker, to whom this rack origination was intrusted, is a careful man, who looks a long way forward and keeps a record of what he does, and he kept a log of this job, and turned the log book in to his superiors when the job was done, which is much to be regretted, as that log book, which contained matter of the utmost interest, cannot now be found, and Mr. Collins' narrative from memory of course lacks many details, of which the practical tool maker would most willingly be informed.

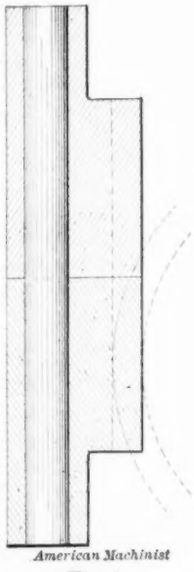

Fig. 4

TWO RACK BLANKS READY FOR CUTTING.

The first step was to make some twenty trial pieces of cast iron of recorded foundry mixtures, and plane them up and cut them into half inch pitch racks at a slow speed in the Whitworth rack cutter, a number of new cutters having been made for this trial operation, and various cutters being tried in these trial blanks, and the resulting racks undergoing careful inspection and measurement for variations. This preliminary work resulted in the selection of the cupola mixture and cutter deemed most suitable by Mr. Collins, and the double rack blank for the two original racks was cast from the selected mixture, planed up, found to be perfect in texture, and drilled and reamed, doweled with half inch pins, five or six in number, and then cut in two lengthwise, all as shown in section in Fig. 4, 11 feet long. This gave the blanks in which the teeth were to be cut.

The preliminary work done on the short trial racks demanded all attainable accuracy, because the results shown on these short racks were to decide the course to be pursued in cutting the final work. Therefore the Whitworth rack cutter was taken to a room, fitted up for the purpose in the basement, and set up and carefully leveled on a stone foundation. A number of new cutters had been made for the rack teeth, and of these one far exceeded all the others in endurance, although they should have all been the same, being made from the same steel and tempered by the same man. The good cutter thus selected by trial proved very good indeed, and cut the 264 teeth in the 4-inch face double 11-foot rack, without perceptible change of form. These trial racks were cut to prove the cutter shapes, to determine the foundry mixture to be used, and to obtain the exact angle of the rack teeth which would give the correct contact with the rack and the tangent screw, parallel to each other.

This Whitworth rack cutter is in the

general form of our tool room "universal" milling machine of to-day, being a pillar and knee machine, the cutter spindle head remaining stationary and the rack blank being secured to the long traveling slide carried by the knee. This is unquestionably a faulty rack cutter construction, because the rack blank support varies with every rack tooth cut, and because, when long racks are to be cut, a very long and heavy blank-holding table or vise has to be moved in tooth spacing, this table or vise weighing many times more than the moving bracket which carries the cutter spindle in the form of rack cutter adopted by the Hoe Company, in which the blank is secured to a stationary table forming a part of the frame of the machine. There is an essential difference in these two forms of the rack cutter, and all of the conditions are in favor of supporting the rack blank on a stationary fixture bolted to the machine bed, and moving the cutter spindle bracket along for each tooth to be cut. Not only does this plan make the machine take the least possible room in the shop, but an analysis of action shows that the likelihood of error is greater when the blank is moved than when the cutter spindle head is made the traveling member.

In the Hoe rack cutters the blanks are clamped to a substantial cast iron fixture which is virtually integral with the frame of the machine; the tooth cut is vertical, beginning at the top, so that every chip drops away from the cut as soon as formed, and the rack blanks are secured by clamps, and hence, if the single face of the rack blank which rests on the fixture is flat, the blank cannot be twisted in the machine, consequently the teeth of the finished rack will extend parallel to each other when the rack comes off the machine and lies at rest. Very much more might be profitably said on the form of the rack cutting machine and the location and direction of travel of its parts, but what is here said is enough to direct the attention of the designer to the important points of least over all length, uniform blank support, uniform cutter support and a uniform cutter action secured by perfect automatic chip delivery. It must not be expected that any multi-toothed cutter will show a uniform action if it is so placed and operated as to be constantly recutting previously formed chips, because all of these chips are metal wedges, and no two are presented to the cutter teeth for recutting in the same position, hence a varying action is certain, and a chip may be caught by a cutter tooth working in such a groove as is produced in rack cutting, in such a manner as to easily take out all the slack in the spacing mechanism connections, and so vary the actual space position.

The Hoe rack cutting machine was all finished, except its cutter spindle knee moving mechanism, when it was used for cutting its own spacing rack. The cutter slide in the knee which gives the cutter spindle its vertical travel is fitted with a solid upright guiding face and an adjustable gib, with no angular adjustment whatever, thus giving the cutter a fixed and certain direction of travel, which could not be assured if an angular adjustment was introduced. Therefore a tapering shoe was fitted under the traveling knee, corresponding exactly to the angle required to bring the rack and tangent screw parallel, and a temporary lead screw having a wheel and handle to move it, was supplied. The adjustment of the cutter knee was by hammer, the hammer blow in this case being delivered not to the moving knee, but given by a mallet on the screw wheel handle. The rack blank was clamped to a long fixture secured to the work table, which is about 13 feet long, and another fixture was made 15 feet long and secured to the work table. To this second shoe the 15 foot Brown & Sharpe scale was clamped, lying flat, by a lot of small brass clamps. This scale is graduated to the edge with very fine lines, not to be readily seen by the naked eye. A goose-neck bracket was bolted to the traveling cutter knee and the first attempt at reading the scale spacing into the knee movement was made by a 2-line spacing slide moving on the goose-neck face. These two lines were formed of fine line edges on the lower ends of two thin slips of steel, placed exactly half an inch apart and fixed in a little slide fitted with a screw to move it up and down on the goose-neck end, and it was thought that these fine line edges could be read exactly into position with the half-inch scale graduations with a magnifying glass, and a few of the rack teeth were cut by this scale reading device, the knee being, of course, firmly bolted down to the machine bed after each location was effected.

But it was found very quickly that this method of reading was entirely unreliable, as the gage showed a difference in the thickness of the rack teeth produced. A 3-inch scale was then secured to the end of the goose-neck, so that the reading could be made with a glass by comparing the location of the half inch marks on the long scale clamped to the fixture on the machine bed, and the graduations on the 3-inch scale carried by the traveling knee. This was found to be much better, and a 3-inch scale was graduated with fine half inch spaced lines by Brown & Sharpe, and clamped to the goose-neck end. Both the 15 foot scale and the 3 inch scale were graduated to the edge, both lay flat, and were so carefully placed as to just clear each other for the whole length of the knee travel on the bed.

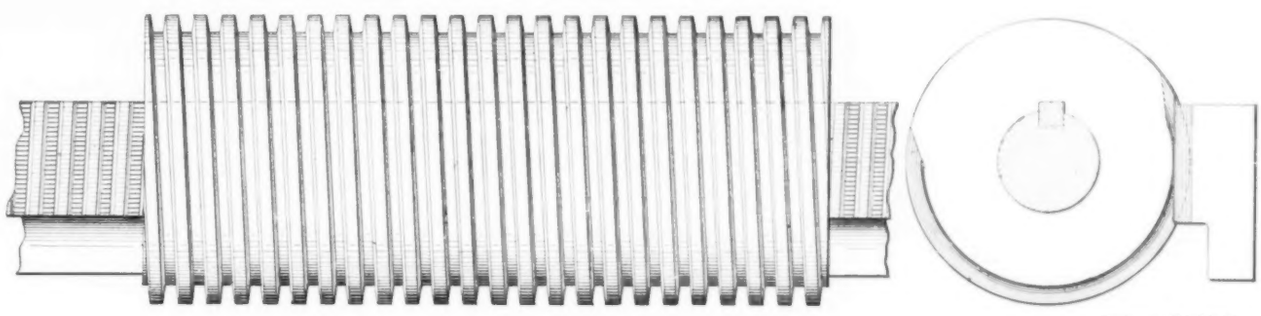

Fig. 5

SCREW AND SECTION OF RACK.

Fig. 6 is a sketch of the arrangement of parts, as evolved from the recollection of Mr. Collins. The bed of the machine is of unusual form, having a plain, flat elevated work-supporting surface or table, *T*. This table is flat and forms an integral part of the bed. It is not used directly to support the work, as such a course would wear the table out of true. Fixtures are bolted to the bed *T*, as *F*, which is represented as supporting the rack blank *R*, which stands on its lower edge and is held by a number of screw clamps. *H* is the cutter spindle slide, having a vertical movement in the knee *K*, dovetailed to slide on a horizontal surface of the bed *D*, which is considerably below the work table *T*. *G* is a goose-neck bracket, bolted to the traveling knee and carrying the 3 inch scale laid flat so

that the end of the scale shows as at *S*, almost touching the 15 foot scale, the end of which shows at *S* 2, carried on a high fixture, also bolted to the work table.

The rack blank *R* does not seem to be very securely held on its edge by the straps and screws, as it has no support at the back. Reference to Figs. 1 and 2 shows precisely the same manner of holding the blanks, and all rack blanks are so held in cutting at Hoe's without the smallest difficulty. The advantages are that the blanks need have only one surface at right angles to the tooth face, and there is only this right angle surface

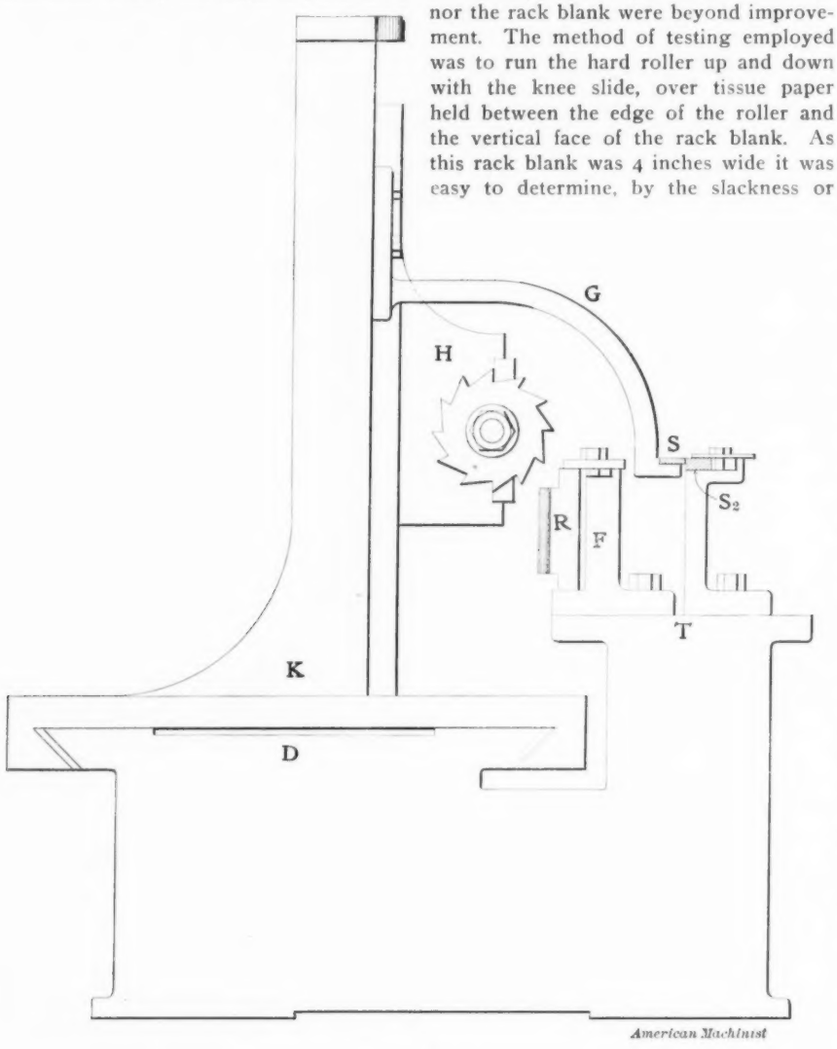

Fig. 6

SKETCH SHOWING ARRANGEMENT FOR CUTTING RACK TEETH.

and the face of the fixture to clean when the work is placed in the machine. The straps or clamps, as seen in Fig. 3, are very substantial affairs with adjusting screws in the outer ends.

This device, shown in Fig. 6, was found to give very satisfactory readings, as there were always six lines of graduation under comparison, almost touching each other at their ends, the scales being separated by perhaps a quarter of a thousandth or so. The remainder of the rack teeth were cut with knee positions obtained from comparison of the graduations of the two scales with a glass magnifying not more than five or six diameters, if so much.

Although the bed of the rack cutter had been carefully scraped before the rack cutting began, and the rack blank had been finished with equal pains, it was found, when both were tested by placing the rack blank on the bed and comparing it at various points by use of a hardened and ground disk mounted on a hardened and ground axis, in place of the cutter, that neither the machine bed nor the rack blank were beyond improvement. The method of testing employed was to run the hard roller up and down with the knee slide, over tissue paper held between the edge of the roller and the vertical face of the rack blank. As this rack blank was 4 inches wide it was easy to determine, by the slackness or tightness of the tissue paper, where the surfaces of the bed or the rack bearing needed correction. The correction of the bed and rack blank and the setting of the latter in correct position took a long time, but the rack was finally brought to where the roller held the tissue paper about like, end to end, top, bottom or middle.

It would be a very useful object lesson for some of our present generation of tool makers, who rely so exclusively upon the accuracy of the machine tools which they use, to attempt to place a piece 11 feet long and 4 inches wide so that the same roller in a traversing slide would hold a tissue paper slip at any point.

It took thirteen weeks to cut the teeth in this 11 foot rack. Some days two teeth were cut, some days three, and some days none at all. No work was done if the temperature of the machine, as read

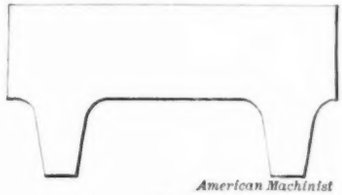

Fig. 7

ONE OF THE THIN GAGES.

from little tripod thermometers set upon the bed, was under 65 degrees or over 70 degrees, and nothing was done under the slightest doubt. If there was a question the question was fully answered before another move was made.

In spite of all this time and care used, there was a greatest difference of nearly two thousandths in tooth thickness when rack cutting was completed. The total length of the rack, however, as well as the location of a great many of the intermediate teeth corresponded exactly with the graduation of the long scale, and it seems not improbable that, with the 12 inch length of worm threads, comparatively little work was needed on the rack teeth themselves to make the spacing, effected by the rotation of the worm threads engaging the rack teeth, give a practically uniform movement to the cutter knee. This 12 inch worm was 5 inches diameter, 2 p. i., having twenty-four teeth constantly engaging the rack. This action, of course, groups the rack teeth into aggregations of twenty-four for working effect, and must have the result of very greatly, if not wholly, eliminating the detrimental effect of very small individual variations of the rack teeth and spaces. But although the worm was only 12 inches working length and had been cut with the greatest care by an excellent lathesman, it was not faultless by any means. Its total length was very nearly 12 inches for twenty-four turns, but it had easily discoverable intermediate variations, such as are well known to be very difficult to avoid with a thread cutting tool of large extent of cutting edge. Generally considered, however, this worm was nowhere seriously out of pitch, and no attempt was made to correct it, as worm errors in this combination merely reduce contact points and do not affect accuracy of movement of the cutter knee, provided that the rack teeth are accurately pitched. In other words, a faulty worm only gives less wear resistance. The rack teeth were finally made as near right as Mr.

Collins could make them with a scraper and four thin templates and three wide face templates. The thin templates were made of sheet steel about 1-32 inch thick, one taking the standard tooth shape and three of the form shown in Fig. 7, but of different lengths, their teeth entering respectively the first and third, first and fourth and first and sixth rack spaces, so that they included, respectively, two, three and five teeth. The three thick templates were 2 inch face, same as the finished racks, and were roughed out on the shaper first and then carefully fitted by file and scraper to have exactly the same profile as the thin templates. It seems hardly within the skill of any man to have produced these wide face templates in perfection, but their faults, if any, were too small to be decisively proven, and they were passed as exactly corresponding to the thin templates, and both the thin and thick templates were approved as correctly to pitch, for exactly including two, three and five correctly spaced rack teeth. These templates were used with the naked hand, no wooden handles being employed to reduce temperature changes. It was, of course, no very long job to bring the rack teeth "pretty near" by use of the tooth gage and the templates. And then began what Mr. Collins describes as "a job to drive a man out of his senses."

The dowels were driven out and the two racks separated at the outset of the tooth correction, one of the racks being laid away for machine No. 2. The whole operation of tooth correction consisted of finding variations in tooth thickness, by means of the thin steel tooth profile template, which demanded only ordinary care and patience and delicacy of touch, and the determination by means of the straightedge and the two, three and five tooth stepping templates, which side of the too thick tooth should be reduced, and finally scraping off a dust of cast iron, hardly to be seen without a magnifying glass, with a scraper as sharp as a razor.

Mr. Collins, although at this day exhibiting a comfortable rotundity of person, great cheerfulness of temper and a hand steady as a clock, declares that it made him "nervous," and that it was his regular practice to work on the rack teeth as long as he could endure it, and then go at something else until he recovered his confidence.

The trouble was to know which side of a thick tooth should be reduced to carry the grand average of the spacing toward perfection. The two, three and five tooth templates made stepping in any tooth multiples possible, the wide face templates could be used as rubbers, and the tooth profile template could detect very small variations in tooth thickness, but which side of the tooth should be scraped could only be determined by end to end steppings in both directions, and, having no "putting-on tools" with him, Mr. Collins was naturally desirous not to take anything off from a tooth until he felt sure he knew which side to scrape, and he refers to the final operations on those rack teeth as an agonizing tribulation unpleasantly remembered. It is impossible to believe that all of these templates, thick and thin, coincided precisely in pitch, and it is easy to see how, as the rack teeth neared machine shop perfection in pitch and thickness, one stepping with the templates should say a tooth was full on the starboard side while a different stepping would show that the port side was the one to scrape. It was Mr. Collins' own intention to stay with that rack until he himself could find no fault with any part of it. He did not do so. He worked on it until he could not be sure where to do any more, and let it go at that.

Rack No. 2 went into the second rack cutting machine with but a tithe of the labor expenditure in corrections which rack No. 1 had, and no difference is discoverable in the accuracy of racks cut on the two machines. Hence it is only a fair inference, since both racks were finished by Mr. Collins, that he concluded that he expended much unavailing toil on the first one. Perfection is a noble aim, but "good enough" is as good as if it were better, and it is a very wise machinist, as well as a very wise shop manager, who can draw the line at the precise point in machine construction when added labor is wasted effort.

But it has always been the policy of the Hoe Company to build their work the best they knew, and their unstinted expenditure in this instance has undoubtedly given the Hoe shops a rack which, for all practical purposes, may be regarded as accurately spaced through the whole 11 feet of its length.

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Technical Publications.

MACHINES TYPOGRAPHIQUES ET PROCEDES D' IMPRESSION (Typographical Machines and Processes of Impression). By A. L. Monet, with a preface by G. Chamerot, President of the Chamber of Typographical Printers. Third edition, completely revised; 484 pages, 6½x10 inches. Paris: Gauthier-Villars et Fils, 55 Quai des Grandes-Augustins.

The author is an experienced writer upon typographical subjects, and during about twenty years past has been awarded many medals for his works. The present volume, as far as page 172, comprises a description of the various kinds of printing presses up to date. Although among the modern ones attention is particularly paid to those of French make, it is not limited to them. The remainder of the book is chiefly occupied by the subject of impression and contains a practical treatise upon the operation of the press and many topics connected therewith, such as lubrication, rollers, paper and the printing of illustrations, both plain and in colors. The wood cuts, of which about 100 are scattered throughout the work, are apparently not intended to exemplify the highest triumphs of the engraver's skill, but this is made amends for by halftone embellishments showing "The Magnificat," produced by that process in three colors and in each of the composite ones. We think that the printer who is not debarred from the perusal of this treatise by the language in which it is published will find it a useful text-book upon his art.

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We have received a copy of rules and conditions of the Twentieth Triennial Exhibition of the Massachusetts Charitable Mechanic Association, to be open from October 10 to December 3, in Boston. A special effort is being made to make this twentieth exhibition specially attractive, and with good prospects of success. No charge is made for the space occupied by mechanical exhibits, and exhibitors paying regular tariff freight rates to Boston on exhibits can have same returned to point of shipment free of charge. No medals, diplomas or awards are given, and preference will be given to those applicants for space who intend to give working mechanical exhibits. Full particulars may be obtained by addressing Horace T. Rockwell, president of the board of management, 99 to 149 Huntington avenue, Boston, Mass.

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Adolphe Janssens, of 16 Rue de la Republique, Paris, sends us a photograph of his exhibit at the recent Automobile Exposition in that city and also a catalog of tools handled by him. This shows that Mr. Janssens was a prominent exhibitor, and that he did much to make American tools known among those in France who are interested in motor carriages.

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British Consul-General Murray reports from Warsaw that the Russian people are just coming to the use of clocks, and that there is a great market in Russia for cheap showy clocks and watches. They should be sent in pieces and put together after entry to evade a high duty on the finished articles. They must be cheap.

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A large floating dry dock is much needed at Portland, Ore., and the British consul is suggesting that it is a good and remunerative opening for British capital and enterprise. Where is American capital and enterprise?

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In a recent accident on the Great Western Railway, England, a broken connecting rod ripped open the boiler, scalding the engineer and fireman to death.

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Open Bids for Machinery to Be Used by the Navy.

Some misunderstanding has arisen at times regarding what are known as "open bids" for machinery and tools for the navy. We have received complaints from manufacturers who say plainly that they consider these bids fraudulent, as the bidding is now carried on, for while professing to be so arranged that all qualified bidders may compete, the specifications are in reality so worded as to exclude all but one bidder. For instance, we have before us specifications issued by the Bureau of Construction and Repair for tools to be used at the New York Navy Yard. A portion of the specifications for a 21-inch driller reads as follows:

"Hole in spindle to suit Morse taper; diameter of table, 19 inches; vertical traverse of table, 16½ inches; distance from post to center of spindle, 10½ inches; vertical traverse of spindle, 9 inches; diameter of spindle, 1½ inches; hole in spindle to fit Morse taper No. 3; maximum distance from spindle to table, 23 inches; maximum distance from spindle to base plate, 44 inches; width of belt on cones, 2½ inches; diameter of driving pulleys, 11½ inches by 3 inches face; speed of lower shaft, 240 revolutions per minute. Floor space, 54x22 inches; total hight of drill, 78 inches."

It is of course apparent that several of these dimensions are not at all essential to a 21-inch drill press, if indeed it can be said that any of them are. It is probable that plenty of expert testimony could be brought to show that a 21-inch driller could be made just as efficient and serviceable without conforming to a single one of the dimensions given.

In the catalog of a certain builder we find specifications of a 21-inch driller which are exactly, word for word and figure for figure, the same, and it is of course evident that if the specifications are to be adhered to strictly only this particular builder can bid, because he of course has numbers of these machines in stock or in course of construction, while all others would have to build them specially and copy his design.

On the assumption that this is the real condition, manufacturers have asked why it would not be better to simply purchase the drill selected outright and avoid the bother and the pretense of asking for bids.

We have made some inquiry into this matter and find that the conditions with which naval engineers and constructors are confronted are somewhat peculiar. In the particular case cited, it is explained by a naval official familiar with the matter that these specifications were not intended to confine the bidding to the builder of the particular machine specified, and that, in fact, the result of the bidding showed that this was understood by many if not all builders. He calls attention to the general paragraph accompanying the specifications, which says: "Bids must be accompanied by general plans and specifications of the exact machine offered, and must have the name and address of the manufacturers." This, he says, has been understood to mean that the machine offered need not exactly conform to the specified figures, and the bids were, in fact, considered under that interpretation.

This question, like most others, has its different aspects, depending upon the viewpoint of the one considering it. There is more or less of the feeling among naval officials responsible for such matters that their position is a peculiarly difficult one. The owner or manager of a private industrial establishment may use his best judgment in the selection of a machine-tool and may pay much more for a given tool than he would have to pay for another of the same nominal capacity if in his judgment the extra outlay is warranted by the relative qualities of workmanship or design. But some manufacturers are declared to evidently hold the belief that "open bids" mean that the Government must accept the cheapest thing offered that goes under the name of the thing required.

This would, of course, be fatal to efficiency, and naval officers avoid it, so far as possible, by giving specifications agreeing with a machine already in use or otherwise known to be satisfactory and then requiring substantial conformity to that, the amount of departure allowed being naturally controlled somewhat by the reputation and evident quality of the machine offered. It is claimed that there is, in fact, no better way of getting what is wanted than for the one in charge and who is responsible and knows what is required to select the particular machine best suited to the purpose, adopt it as the basis of specifications and require more or less strict compliance, according to circumstances. It is a belief strongly held in the departments that a Government officer, charged with responsible duties in which he must to a considerable extent exercise discretion, should have a reasonable right of choice when purchasing machinery, as in other things.

A member of the Engineer Corps, in discussing the matter, said: "The Department forbids the asking for patented or proprietary articles unless the officers so asking will certify that nothing else will do, and the Department itself has authorized the drawing of a specification which will procure exactly what is wanted. You can readily see that in certain cases it may be that a particular tool is patented, so that it alone will answer the purpose, and if we are going to get just what we want we must ask for that with all its peculiarities; otherwise we should be in the position of having to take any old thing that was offered, when we wanted and really needed some particular thing."

The fact is, as our readers well know, that it is extremely difficult, if not impossible, to state in terms and in detail in a specification or otherwise the difference between a machine that is first-class and satisfactory in every respect and one that would be second or fourth rate and entirely unsatisfactory. Some approach to it might be attained if, as we suggested some time ago, it were made the custom to specify in terms of exact measurement just how much departure from absolute accuracy would be allowed; how much deflection would be permitted under given loads or stresses, etc.; but as the case stands, and after having given the matter careful attention for the purpose of ascertaining the truth, we are convinced that our naval officers who have charge of such matters act conscientiously and with a view to

the best good of the service, and that is what they are employed for. At the same time, they are of course subject to error, in common with the balance of mankind, and it is to be expected that occasionally a manufacturer, who, if he takes a perfectly proper degree of interest and pride in his business, must necessarily be somewhat prejudiced, will sincerely believe that he has reason for just complaint.

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An Ineffective Boycott.

Some time ago we noted the proposed boycott of Harland & Wolff, the shipbuilders, of Belfast, because they refused to lock out their men, with whom their relations were entirely satisfactory, during the fight of last year. It was proposed to refuse to sell to them any shipbuilding material, evidently with the idea that if British plate-makers, etc., refused to sell them material they would have to go out of business. It does not seem to have worked that way, however. Last May a consignment of the largest size of ship plates was shipped from Pittsburg to Harland & Wolff, and it is stated that at least 800 tons more in plates 28x5 feet are being made by the same Pittsburg firm for the same destination. American pig iron is also being shipped there, and both plates and iron are laid down in Belfast at lower prices than they can be obtained from the manufacturers in the West of Scotland, who have previously supplied the demand.

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Personal.

Mr. Chas. Hawley, of Brattleboro, Vt., has recently taken a position as assistant manager of the bicycle hub department of Bardons & Oliver, Cleveland, Ohio.

Mr. D. E. MacCarthy recently resigned his position as head toolmaker with the Detroit (Mich.) Lubricator Company to occupy a position in the drafting room at Springfield Armory.

Mr. W. H. Readle, until recently superintendent of the Elmira Brass & Iron Works, has taken a position with the Rousseau Electrical Works, incorporated, of this city, as general superintendent.

Messrs. T. K. Webster, president of the Webster Manufacturing Company, and John S. Metcalf, of John S. Metcalf & Co., both of Chicago, started August 16 on the Kaiser Wilhelm der Grosse for a business tour through Europe.

Mr. C. G. Robinson, late general manager of the Petersburg Iron Works Company, Petersburg, Va., has been appointed chief engineer and general superintendent of the Beckley-Robinson Company, whose works are at Garwood, N. J.

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It is said that fifes are being made for the army out of nickel aluminum tubing, which is found to be eminently satisfactory for that purpose.

Obituary.

Thomas Duff, proprietor of the Dumbarton Iron Works, of this city, died August 3, forty-eight years old. He was born in Dumfries, Scotland, and became an engineer of the National Line of steamships at the age of twenty-one, subsequently becoming chief engineer of the line. His work after leaving the line and opening his shop was principally marine repairing.

Lysander Button, who died at Cohoes, N. Y., July 29, eighty-eight years old, was for many years one of the leading builders of fire engines in the United States. He was born in Lansingburgh, N. Y., and began building hand fire engines in Waterford, N. Y., about 1840, developing a prosperous business, and sending his engines all over the country. His steam fire engines, built later, also compared favorably with those of his competitors, many of them still doing good service. He continued in business over forty years, being succeeded by Holroyd & Co. in 1881. Mr. Button had been in feeble health for a long time.

Joel Sharp, president of the Buckeye Engine Company, Salem, Ohio, died in that city July 29, seventy-eight years old. Mr. Sharp had been engaged in machinery and steam engine lines all his life. From 1850 to 1871 he was in the firm of Sharp, Davis & Bonsall, and upon the organization of the Buckeye Engine Company in the latter year became its president and a prominent man in steam engineering. In connection with J. W. Thompson, of the Thompson indicator, he put out the various treatises on steam engine practice bearing the name of the Buckeye Company which have done so much to stimulate the growth of the modern stationary steam engine and to make the company and its products so widely known. Mr. Sharp personally was held in high esteem by all with whom he came in contact. His application in 1884 for membership in the American Society of Mechanical Engineers bore the names of John E. Sweet, Charles T. Porter, E. D. Leavitt, Jr.; Charles E. Emery, Harris Tabor and George H. Barrus. He was vice-president of the society in 1889-91. Mr. Sharp was also one of the founders and ex-president of the Salem Wire Nail Company.

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Present Status of the Storage Battery.

Perhaps the most prominent and most important factor in the problem of the future application and utilization of power is the storage battery, and the following, which we gather from a paper by Joseph Appleton, recently read before the Engineers' Club of Philadelphia, will serve to convey much desired information to those of our readers who are not in close touch with electrical activities.

The increase in the use of the storage battery, as represented by the weight of plates used, has been tenfold in four years, the weight for 1894 being 349,000 pounds and for 1897 it was 3,607,300 pounds.

One of the most important recent applications of storage batteries is in connection with water powers. The stream flows on night and day, while much of the power can be used only for ten hours of the day, and much more for only two or three hours. In one of the largest electric light and power companies of this country one-half of the investment in generators and underground copper is used only 154 hours in the year. On the large water powers there can be no storage of the water, but by using storage batteries energy is stored when the demand is low and discharged when it is above the average. At Niagara Falls electrical energy is sold by the year for $40, more or less, per horse-power. A manufacturer requiring power but for ten hours a day can by the use of a storage battery get along with one-half the amount of power that he would otherwise have to pay for. Although storage batteries are costly, such an investment would soon pay for itself.

In one of the modern office buildings using "Sprague" elevators the load fluctuated between 140 horse-power and zero during an observation of twenty minutes. In combination with the storage battery, both elevators and lights are operated from the same dynamos, and the battery is used for supplying current at night after the generating current has been shut down, taking care of the lights in the building and thirty or forty trips of one elevator. The advantages claimed for the storage battery here are: Smaller generating plant necessary, running one unit instead of two, economy of operation, as the plant can be run at a constant and efficient load instead of a varying one, smaller depreciation of plant and greater reliability.

The largest storage battery installation in the world is in Chicago. The Chicago Edison Company operates a very extensive three-wire Edison system, their maximum winter load in the downtown section alone being 8,000 electric horse-power. They have provided for the prospective increase of business by a storage battery plant capable of delivering 12,000 amperes, or 2,000 electric horse-power, for one hour. The battery consists of 166 cells, each cell containing 87 plates 15½x32 inches. The weight of each cell is 6,200 pounds.

The field for storage batteries for vehicles is almost without limit, and it is prophesied that carriages, cabs, wagons, etc., will yet be as independent of the horse as is already the street car. The

cost of accomplishing by electric vehicles the work now done by horses would be probably one-half, when their adoption became to any extent general, enabling the work of recharging to be organized on a proper scale. From a sanitary point of view much is to be gained by getting rid of the horse, and the problem of good roads is simplified at once. The following advantages are claimed for the electric vehicle over oil or gas motors: A storage battery will not explode and is not inflammable like gasoline or kerosene. The electric motor is more easily controlled than any other. It has a smooth rotary motion, without noise or vibration. It is free from heat and smell. There is no doubt, from tests made, that a vehicle can be propelled electrically with less consumption of energy than any oil or gas motor.

Much has been done toward the development of the electric vehicle in the United States by Messrs. Morris & Salom, who built their first in 1894. The data obtained from this proved that, on good pavements, a vehicle weighing, with passengers, 5,000 pounds could propel itself at a speed of 10 miles an hour with an expenditure of energy not exceeding 0.7 horse-power per 1,000 pounds. These gentlemen later formed the Electric Carriage & Wagon Company and started twelve cabs in regular service in New York city. At this writing fifty more cabs and fifty broughams should also be in successful operation. They are also to be put in operation in other cities. At a speed of 12 miles per hour they take an average of less than 2½ horse-power with forty miles capacity. With an 8 per cent. grade they can make six miles an hour with 7 horse-power, which is far better than has ever been done before. The wheels have pneumatic tires 5 inches in diameter and inflated to about 120 pounds.

In the new stable for the cabs at Broadway, Fifty-second street and Seventh Avenue, eight rows of carging tables are provided, arranged lengthwise of the room. Four different charging voltages are provided, and the batteries are connected to these successively until fully charged. This system of charging is the most efficient that could be adopted, for if the battery is switched on the full voltage it charges very rapidly at first and the current falls to almost zero at the last. An overhead traveler runs the entire length of the charging tables, and from this are suspended eight lifting clutches or arms, one for each row of tables. In front of the tables there is a traveling conveyor which will carry the battery at right angles to the tables. In front of the conveyors are two hydraulic floating platforms on which the vehicles rest. These are all controlled by one man from a small suspended platform. A vehicle coming in to be recharged backs onto one of the platforms and the operator centers the platform opposite an empty section of the conveyor. A grappler runs out and withdraws the empty battery. The conveyor is then moved one section, so that a full battery is placed opposite the vehicle and pushed into position. The entire operation of changing batteries takes less than two minutes. The Edison Company is also to provide charging plugs in the street, all over the city, so that, if necessary, a cab can pull up alongside and fill up.

The Pope Manufacturing Company is turning out vehicles which are beautiful specimens of workmanship. It has an elaborate and severe series of tests for its vehicles, among others an obstruction test. The carriage is run at a speed of 5 miles an hour, one side of it against and over an obstruction 10 inches high. The bump is sufficient to lift the occupant about 4 inches off his seat.

As these carriages are used by the general public a different system of recharging is adopted. An ordinary 110 volt circuit can be used in recharging and the batteries are charged in place. A specially designed watt meter is placed under the seat, which runs backward when the battery is charging, and at a certain slower rate of speed than when the vehicle is at work. Instructions are given to continue the charging until the meter returns to the full position. This insures that a certain percentage of increase of current over what has been taken out has been put back into the batteries.

The Fischer Electric Equipment Company, of Chicago, is preparing to operate in that city vehicles of all descriptions. It proposes to furnish the entire electrical equipment to different carriage builders, they doing the rest according to the requirements of their trade. The use of solid rubber tires is recommended instead of pneumatic tires, as the latter are said to take 20 to 50 per cent. more power, besides deteriorating rapidly. The "nickel-in-the-slot" system is also to be employed for recharging.

The Riker Electric Motor Company is also building electric vehicles which already have a good record. One or more of these are used by Altman & Co. for delivering goods in New York city.

A recent application of storage batteries is in telephone exchanges. The new exchange of the Bell Telephone Company in Philadelphia has the most complete and modern equipment. It has a battery of ten cells furnishing the current for calling up and talking, four cells, installed in duplicate, for operating disconnected signals and relays, and two cells to supply current for the operators' transmitters and signal calls. Telephone engineers say that it is only a question of time when all exchanges will have their batteries centralized in this way.

Commercial Review.

NEW YORK, SATURDAY EVENING, Aug. 13.

THE RETURN OF PEACE.

The signing of preliminary articles of peace has put such a new face upon business that no predictions founded upon its past characteristics can do justice to the situation. The country is now looking forward to increased prosperity in much the same way that it did after the election of 1896, but with better prospects of success. For one thing, a revival has been in progress for more than a year, and its new structure will be built upon a firm foundation. Moreover, the country was in 1896 divided upon the satisfactoriness of political results, but if anyone now objects to the consummation of peace he has sense enough to keep still about it. Further, this is an ideal season of the year for improvement to begin. Peace has come just in time for fall trade.

Now, with regard to the new markets opened for our wares, there may be some misapprehensions. The Cubans and Puerto Ricans and Philippinos are not going to buy any old thing we choose to send to them. They have very little money to spend at present. It seems likely that the avenues of trade will be opened, however, as speedily as possible by American capital. The soil of Cuba is too fertile for enterprising men in the North to resist the opportunity of investment it affords, and with the foundation of new enterprises must come a demand for supplies of various sorts, chiefly to be furnished by the United States. For instance, it is inconceivable that a large amount of sugar machinery will not soon be required to re-equip the plants destroyed by the insurgents. More than a week ago a number of commercial men set sail for Ponce, and numerous enterprises for West Indian development have already been formed in our large cities.

It is not to be doubted that we shall receive the lion's share of Cuban trade. Even under Spanish rule we obtained a considerable portion of it, despite the discriminating duties in favor of the home government, which showed how superior would be the advantages of trade with us under equal conditions. There is, however, a disposition on the part of our Government to introduce the policy of the "open door" in its dependencies or quasi-dependencies. Even such a strong tariff man as Mr. McKinley apparently recognizes the fact that the doctrine of protection of industries is inapplicable where such industries do not exist, and if a liberal policy in this respect is satisfactory to the protectionists, a fortiori it must be so to the free traders. Let us then rid ourselves of the idea that the West Indian Islands are going to be an exclusive game preserve for us, and let us rather practice to increase our accu-

racy in bringing down birds of business in rivalry with the Germans and others who are good marksmen.

MACHINISTS' SUPPLIES AND TANGENT LINES.

We have listened to statements from a great many local sellers this week, and must base whatever bright predictions for the future are to be made rather upon the general outlook than upon any exceptional circumstances that have occurred in New York supply houses during the last month. It may be said, however, that several of them see improvement and that certain shops are reported very busy. It is rather early in the season as yet to expect much change in the situation.

An inquiry has come to a certain American manufacturer of grinding machinery to furnish about 100 machines of various sizes for the replenishment of a dealer's stock in Germany.

The Diamond Machine Company, Providence, R. I., which, for many years, has made a specialty of knife grinders for sharpening all classes of knives used in planing, paper, bark and tin plate mills, etc., writes that since January 1 of this year it has been very busy in this department of its works. It has just shipped a 90-inch machine to Germany and is building one of the same size for a concern in Waterbury, Conn., as well as several smaller ones, which are going abroad. Many of its machines have gone to South America, South Africa and Japan.

An exporter in this city who, within a few days past, has purchased considerable quantities of machinists' supplies for the London market, is quoted as saying that the demand for American files is quite noticeable in British shops.

The prices of wrought iron pipe and of steel tubing have lately been somewhat advanced. The increase is about 5 per cent., but more than that on some fancy tubes and on casing.

Inquiry of several power transmitting machinery concerns educes the fact that the large ones are very much crowded with work at their shops, and there are even symptoms of a present improvement in demand. The Brooklyn Wharf & Warehouse Company, which lately installed the grain handling plant built by the Webster Manufacturing Company, has subsequently been making further extensive purchases of conveying or power transmitting machinery, the bulk of the late orders falling to the Dodge Manufacturing Company, though part went to the Webster Company. The Webster Company is still so busy that it has to turn down orders. It recently accepted one to install a quantity of new machinery to equip the Central Elevator, Chicago.

A local power transmitting machinery concern mentions a considerable export demand recently from Copenhagen and Scandinavia. Goods are being sent also to South Africa and Mexico, in which latter country the company has had occasion to make consignments to its representatives.

One of the brightest spots on the machinery market at present is gas engines. Aside from seasonable fluctuations, they can be pronounced as manifestly increasing in sales in this market. Several concerns with whom gas engines are but one of many lines have singled them out for comment as in particularly good demand.

Olney & Warrin, who opened a machinery and supply house in this city a few months since, and have a manufactory in Brooklyn Borough in connection therewith, remark very satisfactory conditions, they being particularly busy on steam and gas engines and special machinery.

A local supply house has just shipped an ice plant, the boiler included being about 160 horse-power, to Santiago, and has also made shipments to Puerto Rico. As these were all army orders, however, they cannot be set down to the glory of Cuba or Puerto Rico.

NOTES ON FRANCE.

Mr. Geo. Montgomery, of Montgomery & Co., one of the chief machinists' supply houses of this city, has returned from a short business trip in France and Switzerland. Mr. Montgomery went abroad last year and the year before, so is in a position to compare the business appearances of successive seasons. He notices a much less willing spirit on the part of French manufacturers to place orders than characterized them last year. The shops seem to be busy, however, and their proprietors talk as though they intended to make purchases eventually, speaking still in high terms of American tools. There is reason to hope, therefore, that conditions will speedily resume their old footing. The state of business at home, as it impressed Mr. Montgomery on his return, although somewhat quiet, was less so than he had expected to find it.

There is no fear that the rather stately relations which for some time existed between this country and France, because of the attitude of the latter toward the former in the Spanish war, will prevent a goodly representation of American exhibitors at the exposition of 1900. For portions of the 150,000 square feet of space allotted to us for exploitation of our industries 600 applications have already been received, one concern alone asking for 75,000 square feet. An attempt is being made to have the American allotment increased to 500,000 square feet, and half of that is said to have been conceded already. The forthcoming exposition is producing activity in France in certain lines, and it is even thought that some indirect benefit from it can be detected on this side of the water.

MISCELLANEOUS.

A Chicago press dispatch says that contracts have just been let which will result in the completion of the electric plant at the Snoqualamie Falls, Washington State, by which the cities of Tacoma and Seattle, each about 22 miles away, will be supplied with electricity for lighting and power. The installation is regarded as one of the most, if not the most, important of its kind yet attempted in this country. The river has an unbroken fall of 270 feet, and its flow is equal to 30,000 horse-power at low water, but by means of reservoirs this energy can be increased to 100,000 at a small additional expense. The power-house is hewn from solid rock 250 feet below the crest of the fall.

Orders of considerable magnitude have recently come to Bement, Miles & Co. from abroad. Among the machines purchased are eight gun lathes for England, heavy tools for Russia and large boring mills, planers and lathes for various foreign destinations.

The Philadelphia Engineering Works have received orders for one cross-compound 300 horse-power condensing Corliss engine for shipment to Yokohama, Japan, with two 100 horse-power vertical water tube boilers, two 300 horse-power horizontal cross-compound Corliss engines for shipment to China, and one 450 horse-power vertical cross-compound Corliss engine for Honolulu.

A contract to install an electric light plant at Battery Jasper, Sullivan's Island, S. C., has been awarded to the New

Continued on page 36.

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Cutters, reamers and small tools, regular and special; vertical millers, cutter and surface grinders, shears and punches. R. M. Clough, Tolland, Conn.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Automatic machinery designer; 6 years' best experience; graduate. Box 185, AMERICAN MACHINIST.

Foreman pattern maker, competent draftsman, 15 years in charge. Scott, 65 Monmouth St., Newark, N.J.

Mechanical draftsman desires position; 14 years' shop and office experience. Box 186, AMERICAN MACHINIST.

Foreman, pattern and draftsman; a good, steady, reliable man; good ref. Box 191, AMERICAN MACHINIST.

A good man—who wants him as foreman in machine shop or outside constructing engineer? Box 184, AMERICAN MACHINIST.

A position wanted as superintendent of machine shop, by a first-class mechanical engineer; best references. Address Box 175, AMERICAN MACHINIST.

Experienced toolmaker and traveler would like to connect with some good firm in outdoor capacity; exp. in screw and autom. mach'y. Box 183, AM. MACHINIST.

Cuba, &c.—Exp., capable mech. engr. wants pos where knowledge Spanish language needed; draftsman, mach; bus. training; translate catalogues, &c.; give val. pointers to mfrs.; ref. Box 188, AM. MACH.

Continued from page 35.

Jersey Foundry & Machine Company at $5,542.

The import trade of South Africa in 1897 amounted to $129,150,128.54, of which $38,670,362.42 was received from British possessions and $13,151,051.24 from the United States, while Germany supplied demands to a value of $5,122,738.36. But Germany is making every effort to increase her hold upon these markets. During 1897 our own exports to that country showed an increase of 171 per cent. in bicycles and parts thereof and $15,226.38 in builders' hardware. Our exports included agricultural implements, $198,818; tools, $76,813; agricultural, mining and electrical machinery, $1,321,556; other kinds of machinery, $2,399; rails, $33,340; rolling stock, $55,016; other railway material, $8,473; bar steel, 1,262 hundred-weight, and all this to a country which a decade ago would have been considered almost a howling wilderness. Yet it will be seen that there is room for improvement when it is remembered that in 1897, while England shipped 6,000,000 percussion caps, we only shipped 198,000; of guns and pistols, England sent twenty times in excess of what we did; in dynamite we sent 2,000,000 and England 4,000,000 pounds. We furnished 800 pounds of bar iron and England 150,000 pounds, and of corrugated and galvanized iron, while we supplied none, the United Kingdom contributed 400,000 pounds.

Work on the new machine shop of the General Electric Company at Schenectady was begun last week. The contract for the steel construction was let last week to A. & R. Roberts, of the Pencoyd Iron Works, Philadelphia. The cost of the new building was estimated at $175,000. It will be 653 feet long and 166 feet wide. It is expected that the shop will be completed before the end of this year. The machinery will be driven by the current transmitted from Mechanicsville, 17 miles distant. In addition to the new machine shop, the General Electric Company is making several important extensions to other buildings and erecting a large foundry.

The Government of Victoria, Australia, has placed an order with the General Electric Company for six Thomson recording watt meters of 100 volts and varying capacities. These will be deposited in the Electrical Bureau of the Home Office of Victoria, and will be used as the official standards, by which all electricity meters used in the colony will be tested. The General Electric Company is now exceedingly busy, about half of its shops in Schenectady being run on night turn.

An order has come from Mexico to a New York export firm for about $30,000 worth of mining machinery, including a large engine and two boilers.

Situations Wanted—Continued.

Steam Pumps—Wanted by man with 15 years' exp. running piece work shops and outside work; duplex specialty; very best ref. Box 190, care AM. MACHINIST.

Wanted—Mech. position in charge of manufacture of small machy. or general repair work; accustomed to management of men; best of refs. Box 174. AM. MA.

Mechanical engineer; exp.; graduate of Berlin University; best ref.; at present employed, desires a change; pos. with steam engine works in Chicago or other Western location preferred. Ad. Box 187, AM. MA.

Foundry foreman, a first-class man with special experience in one of best shops in this country is ready for an engagement; understands brass as well as iron founding; selecting and mixing irons a specialty for any purpose. Address Walter Wainwright, 87 Stone Street, Cleveland, Ohio.

Help Wanted.

Wanted—A first class toolmaker, capable of taking charge of tool-room; state experience and salary exp. Fort Wayne Electric Corporation, Fort Wayne, Ind.

Wanted—Ten competent all round machinists; only first-class men wanted; experienced in dynamo work preferred. The Bullock Elec. Mfg. Co., Cincinnati, O.

Wanted—A thoroughly competent machinist to give instruction in a shop connected with an engineering school in Mass.; state exp., age, compensation required and send photograph to Box 182, AMERICAN MACHINIST.

Wanted—A thoroughly competent man of exp. to superintend eng. fac.; one prepared to purchase an interest in the bus., which is well estab. and profitable, pref.; must be first-class, up to-date machinist and understand handling men; a splendid opportunity for the right man. Box 189, AMERICAN MACHINIST.

Wanted—A concern manufacturing high grade machine tools wants a superintendent who is thoroughly familiar with modern practice and able to produce first-class work at low cost; preference will be given a man who has held similar positions; a good opportunity for the right man; none but strictly first-class men need apply. Address with terms, experience, age, references, &c., Box 180, AMERICAN MACHINIST.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Best Calipers, Levels, etc. E. G. Smith, Columbia, Pa.

Book, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Die makers, special mach'y and spec'lt'es wanted for manufacture. Bown Mach Works, Battle Creek, Mich.

The advertising department of the American Machinist has on hand 20,000 draftsm'n's thumb tacks; will send a box of ten to any draftsman in America on request; could use a postage stamp on box, but will send the tacks anyway.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

Excellent opportunity to establish a branch factory in the most industrial part of Germany is offered American mfrs. of cycles, sewing machines, machine tools or similar articles, by an active and intelligent German business man with sufficient pecuniary means at his disposal. Applications will be duly forwarded by Wm. Essenwein, Rosenstrasse 8, Dusseldorf, Germany.

WANTED.

One 5 to 6 foot Planer.

One Horizontal Boring Mill, with 7 to 8 foot bar.

1,000 lb. Steam Power Hammer.

Traveling Crane of from 12 to 15 ton capacity.

MACHINERY, care of American Machinist.

OIL FILTERS

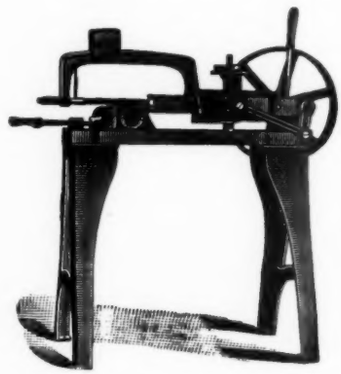
THE BURT MFG. CO., Akron, O., U. S. A.

"The best is as good as any."

The New

Automatic and Gravity Feed

Q & C Shop Saw



Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

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For All Purposes.

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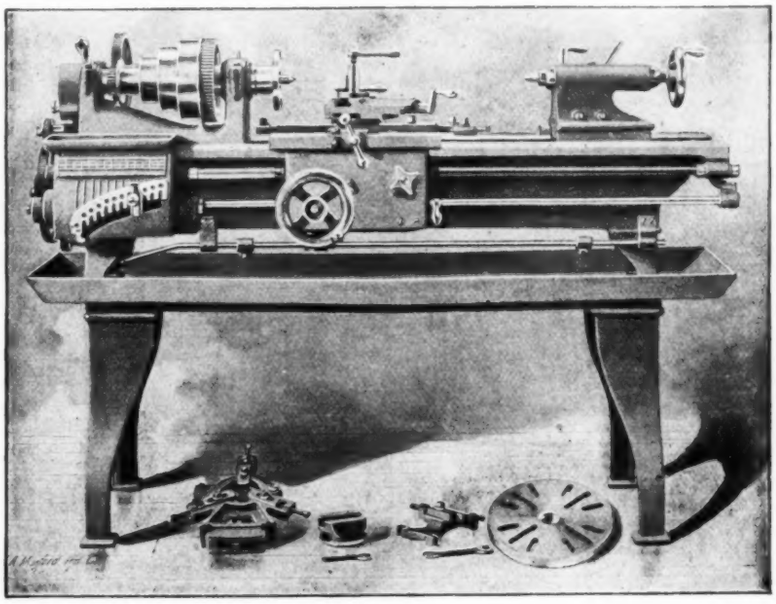
12-in. Hendey-Norton Tool-Room Engine Lathe.



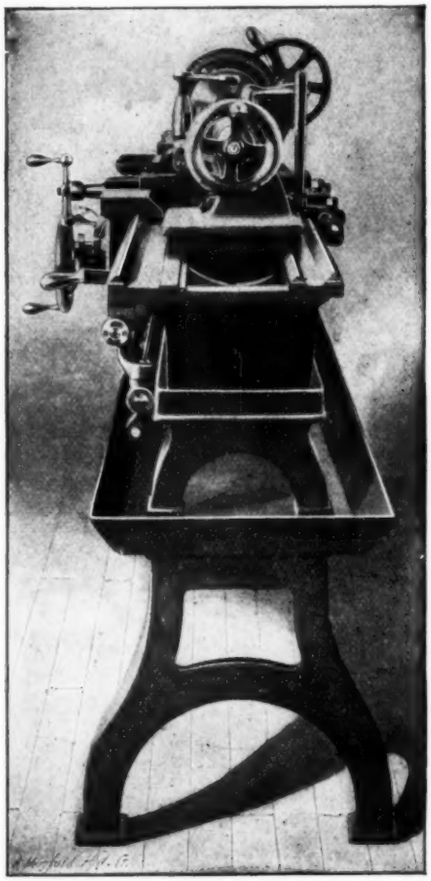
Complete in every respect as our larger sizes of lathes.

Especially designed for work in tool-rooms, experimental stations, and fine machine and repair shops. Fitted with either rise and fall or plain carriage. With or without improved taper attachment in connection with plain carriage.

This Lathe can be fitted with wire chucks in any decimal under half inch, which are invaluable for finishing small taps, reamers, special screws and studs, and other work right from the rod—no cutting off and centering of work required.

Cross-feed screw graduated to thousandths of an inch.

Beds made in 4 ft., 5 ft., and 6 ft. lengths.



END VIEW OF THE HENDEY-NORTON ENGINE LATHE.

The

Hendey Machine Co.,

TORRINGTON, CONN.

Agents for the Pacific Coast: Pacific Tool & Supply Co., San Francisco, Cal.
J. W. Cregar, Philadelphia Bourse Exhibition.

European Agents: Schuchardt & Schutte, Berlin, Vienna, Brussels; Chas. Churchill & Co., Ltd., London and Birmingham, England. Adolphe Janssens, Paris, France.

CHICAGO MACHINERY MARKET.

The convalescence of the machinery trade has been more notable during the past week than for some time. The patient has not been discharged, but thinks he sees the day of deliverance in the near future. A spirit of cheerfulness pervades the air, and everyone is looking for a better business next month. The optimism seems based upon the close of the war and the large grain crops.

Machinery supplies are moving more freely into consumers' hands. With no known exception, August trade is pronounced better than that of July. It has been noticed, too, that the orders received within the past few days have been for quick delivery. The supplies were wanted by next freight, and representatives here who did not happen to have the desired goods in stock have been spending much of their time in wiring to their respective houses and in beseeching the railroad companies to give them prompt dispatch. The buyers had put off till the last moment the ordering of needed supplies.

This dilatoriness marks the extreme limit of the pendulum's vibration, the period of the vibration being several years. At its beginning it was customary for the consumer to buy a year's requirements in advance; then he gradually reduced the time limit to one month or less. He not only adopted the hand-to-mouth policy, but, stimulated by a newborn policy of economy, he recovered from the scrap heap a modicum of supplies which ordinarily he would have obtained from the maker. It is not regarded as likely that the change in the manner of buying will be radical at first. Consumers will perhaps suffer to some degree the inconvenience of insufficient supplies before the practice of liberal buying is restored.

Not only are the large shops ordering more freely for all kinds of supplies, but the jobbing houses, that supply the small trade principally, are sending in bills of goods a little earlier than usual. They have bought generally in September. This year they are already ordering.

Machinery trade, on the whole, is fairly active. It is better than at this time last year. It is better than in July. It is not yet what it should be.

Marked improvement has appeared in the iron and steel markets. Local mills are well loaded with orders. They are asking higher prices and are selling at the advances. There are foreign inquiries for plates larger than mills can fill. There are inquiries from shipbuilders on the Pacific Coast. Some heavy bridge work has been placed and car building is taking a large tonnage of steel.

The Chicago branch of the Norton Emery Wheel Company, established here last spring, reports the largest trade so far in August that it has yet had.

Business with the Northampton Emery

Wheel Company is 30 per cent. better than a year ago.

▲ ▲ ▲

Quotations.

NEW YORK, Monday, August 15.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 00 @ 11 25
No. 2 foundry, Northern	10 50 @ 11 00
No. 2 plain, Northern	10 00 @ 10 50
Gray forge, Northern	9 75 @ 10 00
No. 1 foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 50 @ 10 75
Foundry forge, Southern	9 50 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock; Common, 1.05 @ 1.10c.; refined, 1.10 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, 2.05 @ 2.10c., according to quantity.

Copper—Carload lots: Lake superior ingot, 12c.; electrolytic, 11¾ @ 11⅞c.; casting copper, 11⅝ @ 11¾c. for ordinary brands.

Pig Lead—Carload lots, 4.05 @ 4.07½c., f. o. b., New York.

Pig Tin—For 5 and 10 ton lots, 16¼c., f. o. b.

Spelter—Carload lots, 4.45 @ 4.55c., New York delivery, for common brands.

Antimony—In cask lots, 8¾ @ 9⅝c., according to brand.

Lard Oil—Prime city, ice pressed, 47 @ 48c., in wholesale lots.

▲ ▲ ▲

Manufacturers.

Chase & Beebe, South Highland, Mich., will break ground for their new mill next week.

This fall the J. Stevens Arms & Tool Company, of Chicopee Falls, will build an addition to its plant.

Beckley-Robinson Company of New York city, has been incorporated to manufacture mining machinery.

Work has been commenced on the Milburn-Bass Wagon Works, Chattanooga, Tenn., which were recently destroyed by fire.

The Plymouth Rubber Company, whose factory was burned out at Stoughton, Mass., a couple of weeks ago, has decided to rebuild.

Changes are to be made in the plant of the Morse Twist Drill & Machine Company, New Bedford, Mass., in the near future.

A paper mill is to be built at Fulton, N. Y. James Stewart & Co., contractors, of Buffalo, N. Y., will submit estimates for the work.

It is announced that the Massachusetts Cotton Mills Company, of Lowell, Mass., has decided to erect a new mill on its property at Lonsdale, Ga.

William J. Bernard, manager of the Seattle (Wash.) Soap Works, which were burned recently, is busy arranging for the erection of a new plant. It is intended to resume business at once.

The Flint Gear & Top Company has been organized at Flint, Mich., with a capital of $25,000. George C. Wilson, a carriage manufacturer, holds the controlling interest. A factory will be erected at once.

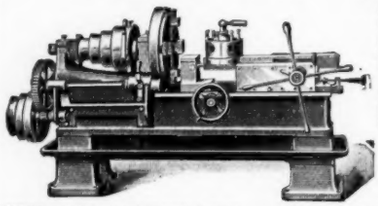
Work began recently on five buildings to be erected by the Northwestern Paper Co. at Cloquet, Minn. The buildings are to be of brick and stone. Work will be pushed to completion at the earliest possible date.

The Western Cooperage Company, Aberdeen, Wash., which was burned out a few weeks ago, has decided to rebuild and will soon start a plant much larger and more complete than the plant that was lost by fire.

The John Good & Jennings Patent Machine Cordage Company, of New York, has recently been formed to engage in the manufacture of cordage-making machinery. Mr. Abraham G. Jennings is treasurer, with Mr. John Good, president.

Hare & Ballinger, architects, have completed plans and are inviting estimates for the erection of a brick factory and boiler and engine house, to be put up on the block of ground at Hancock street and Allegheny avenue, Phila-

FACING AND CHUCKING MACHINES.



FOR boring and squaring up hubs of pulleys, and finishing the sides of web gear blanks with one set of tools at one setting of the casting; made in four sizes; all have turret slide support and face plates, respectively 15, 23, 36 and 45 inch diameters.

FLANGE FACING MACHINES for work upon Hydrants, Valves, etc., have two heads adjustable longitudinally, and face plates with slides having positive feed for tools. Will face diameter 20 and 36 inches respectively.

Ask for the Machinists' Catalogue.

THE PRATT & WHITNEY CO.,

HARTFORD, CONN., U. S. A.

NEW YORK: 123 Liberty Street. BOSTON: 141 Pearl Street. CHICAGO: 42 South Clinton Street.
LONDON, ENGLAND: BUCK & HICKMAN, 280 Whitechapel Road.
PARIS, FRANCE: FENWICK FRERES & Co., 21 Rue Martel.

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Lathes that enables you to handle lathe work in such a way as to insure dividends. Ask us what it is.

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Hill, Clarke & Co., Chicago. F. Pratt & Co., Limited, London.
Franz Kustner, Dresden. B. A. Hjorth & Co., Stockholm

Machine Design. PART I. **Kinematics of Machinery.**

By FORREST R. JONES, Professor of Machine Design in the University of Wisconsin; Member of the American Society of Mechanical Engineers; Associate of the American Institute of Electrical Engineers. First Edition. First thousand. 165 pages, 133 figures. 8vo. Cloth. $1.50.

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"Green River" Patent Spiral Fluted Shell Reamers and Arbors in Cases.

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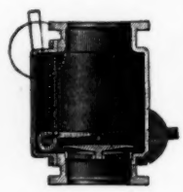

Excelsior Straight-Way Back Pressure Valve.

This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

JENKINS BROTHERS, New York, Boston, Philadelphia, Chicago.

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CUSHION BEARING GRINDER.

Write for information on its advantages over other grinders.

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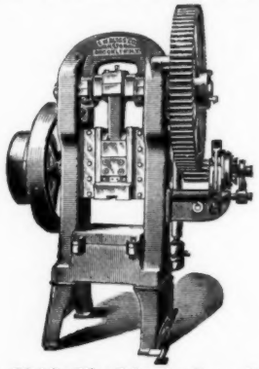

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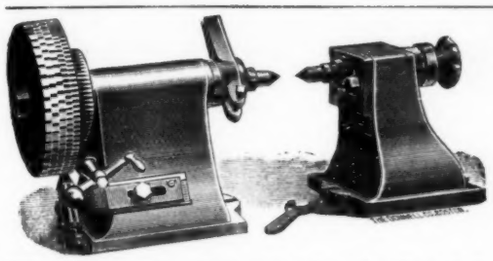
Presses, Dies and Special Mach'y. Bicycle Tools.

Manufacturers of the WALDRON FRICTION CLUTCHES.



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The Fay & Scott kind—the best kind that ever went into a shop anywhere.

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Dexter, Me., U. S. A.

Hill, Clarke & Co., Boston. Prentiss Tool & Supply Co., New York.

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BELT & HAND POWER HOISTING APPLIANCES.
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Cutter and Reamer Grinder.

Ideal Grinder for taper, shell and shank reamers, edge or bevel cutters, any kind of mills. Grinds hollow mills up to 6 in. diameter, reamers 14 in. long, 4½ in. diameter.

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Cleveland, O.

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Adjustable Stock and Dies

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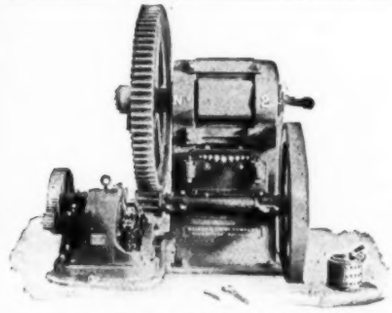

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BUILT BY
Hilles & Jones Company,
Manufacturers of Improved Machine Tools,
Send for new Catalogue. 902 Church St., WILMINGTON, DELAWARE.

THE BENTEL & MARGEDANT COMPANY
MANUFACTURERS OF WOODWORKING MACHINERY
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Lathes, from 12" to 48"; Planers, from 20" up to 60. 48", 54" and 60" Radial Drills; No. 2 Newton Milling Machine; No. 2 Screw Machine; Shapers, from 6, to 30", Boilermakers' Punches, Shears, Edge Planers, Rolls, Drills, Engines, Boilers, Pumps, and Dynamos.

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Who manufactures machines for winding all Musical Instrument Strings, Violins, Guitars, Banjos, Mandolins?
Please address catalogues, &c., to
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WANTED.

Two horizontal boring machines to be used for boring cylinder liners of gas and oil engines, from 6 to 18 inches diameter and 4 feet long. These tools must be of the latest and most modern design for handling work quickly; one man is expected to work both machines.

A Duplex boring machine with independent motions to bars and tables would be favorably considered. The machines would be inspected before being shipped; quick delivery is important. Send illustrations or drawings with lowest prices f. o. b. ship New York, to
The Campbell Gas Engine Co., Ltd, Halifax, England.

delphia, Pa. The factory will be three stories high, with basement, 44.4x250 feet, with a tower arising from the front. The boiler and engine house will be one story and basement, 36.3x73 feet.

Architects John Scott & Co. have completed plans for a factory for the Ideal Manufacturing Company, to be built at Detroit, Mich. It will be 50x160 feet in size and four stories high, constructed of brick with stone trimmings and composition roof.

The Taylor Manufacturing Company, Holyoke, Mass., which recently purchased the Hanmer & Forbes mill property in Burnside, Conn., has had plans prepared for adding three stories to the structure, instead of an addition, as at first contemplated.

A charter was issued recently by the State Department to the Monongahela Saw & Planing Mill Company, Monongahela City, Pa. Capital, $25,000; directors, John H. Jones, J. B. Finley, Harry P. Jones, Frank R. Colvin, John G. Colvin, Monongahela.

Work has already commenced at Corinna, Me., upon the foundation for the new woolen mill structure erected by C. A. Greenwood, whose mill at Dexter was recently burned. The building will be 45x100 feet and double the capacity of the mill burned.

William Steele & Son have the contract for making additions to the factory building at Jasper and Somerset streets for the Orinoka Mills Company, of Philadelphia, Pa. An addition, 55x115 feet, will be erected, two stories, with modern factory improvements.

Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, has closed a deal by which they purchase two acres of ground upon which they will proceed immediately to erect a steel and brick shop of the latest type 300x90 feet, together with warerooms, boiler house, etc. The shop will contain the latest ideas in cranes, air compressors, etc.

A certificate of the incorporation of the Buffalo (N. Y.) Mill Supply Company has been filed with the county clerk. The company is capitalized at $6,000. It will manufacture rubber goods, mill supplies and machinery. The directors named for the first year are William B. Miller and Robert Loder, of Buffalo, and Walter B. Hardy and Andrew H. Noah, of Akron, Ohio.

A. J. Haws & Sons, of Johnstown, Pa., brick manufacturers, have begun the erection of a $50,000 addition to their plant, for the manufacture of high-grade fire brick. The building will be fireproof, 100x150 feet in size and will be equipped with the most modern machinery. The new plant will be in operation within sixty days. One hundred more men will be given employment.

Contractors are now estimating for the construction of an immense ordnance machine shop at the Midvale Steel Company's Works, Nicetown, Pa. The structure will be known as building No. 2, and will be two stories high. Its total width will be 122 feet and length 419 feet, including a lean-to, one story high, on one side, running the whole length. The shop will be built of iron and brick.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

We have received from the Westinghouse Electric & Manufacturing Company a tastefully gotten up brochure in which is described the Tesla polyphase motor for direct driving of machine tools, cranes, and other machines. The advantages of electric driving are enumerated. Graphic illustration of power lost by friction of shafting and belting is shown. Illustrations of these motors driving slotting machines, planing machines, shears and also driving line shafting are presented. The catalog is standard size, 6x9 inches.

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Manufacturers of the Original

TRADE I. X. L. MARK.

Pipe Cutting and Threading Machine.

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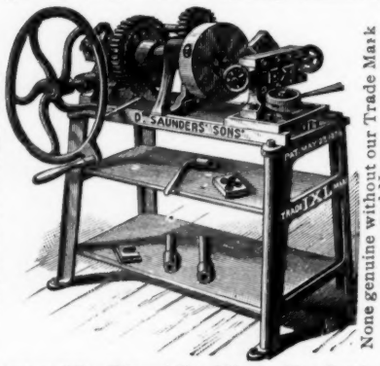

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Steam and Gas Fitters' Hand Tools. Pipe Cutting and Threading Machines for Pipe Mill use a specialty.

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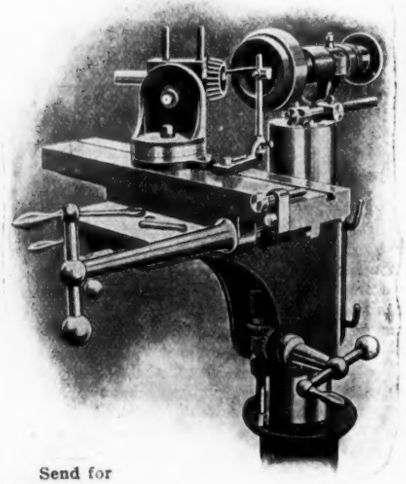
Fixture and Rest for Grinding Angular Cutters.

Wheel runs TOWARD THE CUTTING EDGE of CUTTER.



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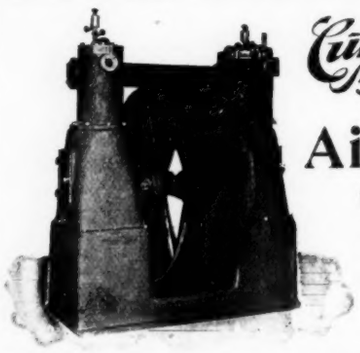

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Make Air Compressors for use with Pneumatic Hammers, Drills, Hoists, Pumps, etc., and for general use in shops, foundries, shipyards and kindred plants.

Air Compressors

built by us are of the highest grade, combining simplicity of design and maximum capacity. We shall be pleased to send you all particulars on request.

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Send for New Catalogue.

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A New Turret Lathe.

For Finishing Castings.

MADISON, Wis., August 10, 1898.

I wish to announce to the machine tool using public of America and Europe that I am now bringing out a new line of heavy turret lathes for finishing castings. No serious attempt to improve this class of machinery has been made for a number of years. The new machine shows decided improvements at every point over the best present practice. The various details, such as the driving gearing, feed motion, turret, chuck, and tool equipment are broadly original, and were designed after a careful and extended study of the requirements of modern manufacturing machine shops; and the machine will produce accurate work at a rate never before attained. For a large class of work the new lathe will turn out from 50 to 100 per cent. more work per day than any existing machine. Furthermore, it can be handled with great ease.

C. M. CONRADSON.

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Drawing Materials and Surveying Instruments.

We make and carry the most complete and best assorted stock in America. Our goods are recognized as the standard of quality. They all bear our trade mark and are warranted by us. Our prices are reasonable. Our lavishly illustrated catalogue minute and correctly describes our goods. It contains much valuable information and is sent gratis on application.

For Heavy Continuous Work

every machine shop will commend our **Power Pipe Threading and Cutting Machine.** Cones are central over machine, equalizing the weight. Within the cones are compound gears giving six changes of speed. Gears require no extra space, and are protected from dust or accident. Chasers can be opened, threaded pipe removed, another inserted and cut without stopping machine

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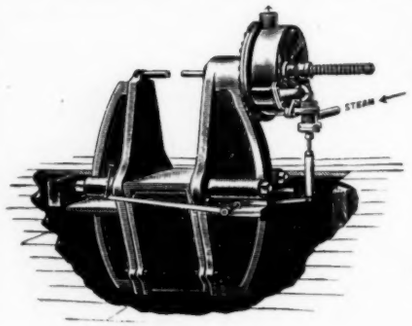

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Direct Acting—Vertical Gap.

Drives 1,000 one-inch rivets in 10 hours. Remarkable for **Rapid and Effective Work, Strength and Simplicity.** Dimensions: Height above floor, 5 ft.; Floor Space, 6 ft. x 2 ft. 6 in.; Jaw, 36 in. deep, 23 in. wide.

Bethlehem Foundry and Machine Co.

SOUTH BETHLEHEM, PA.

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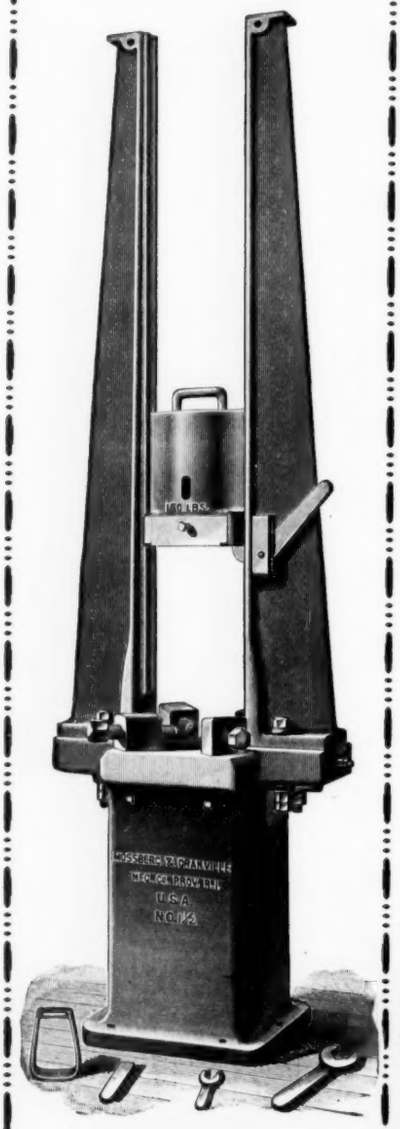

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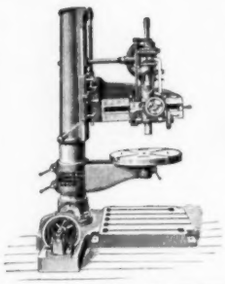

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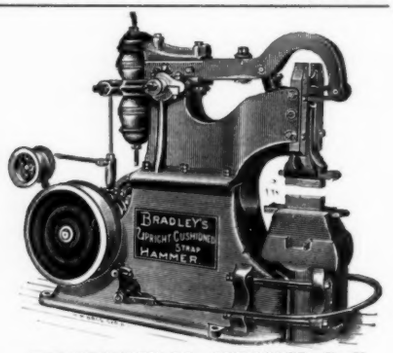

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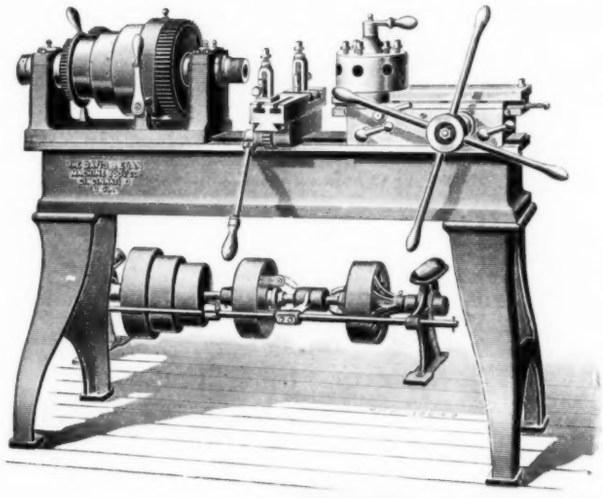

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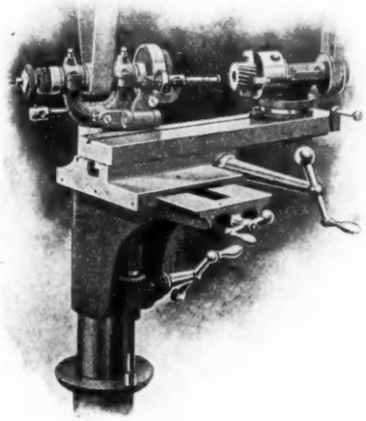

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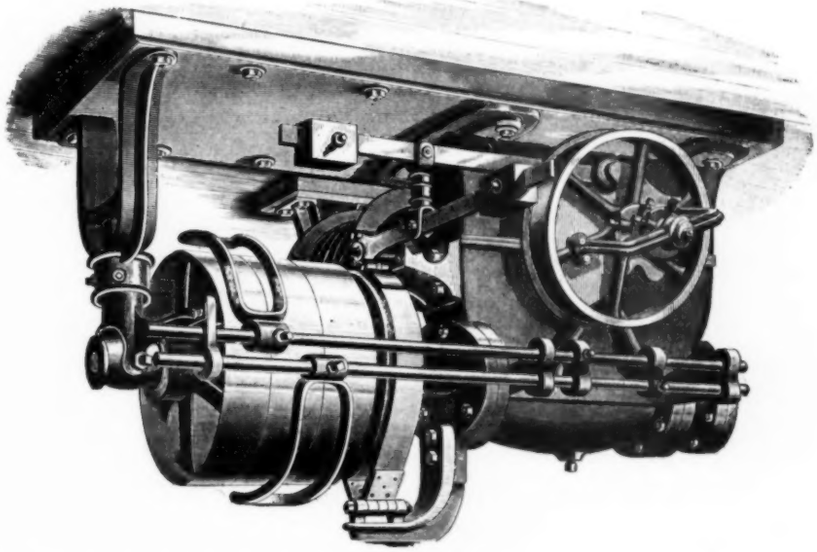

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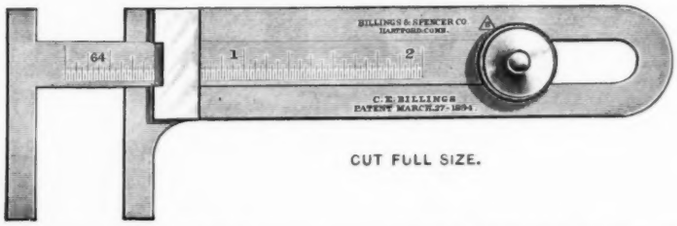

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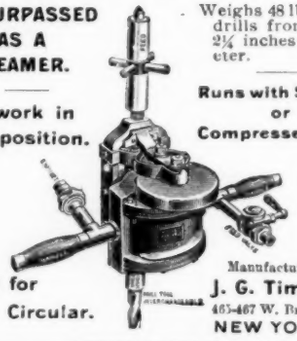

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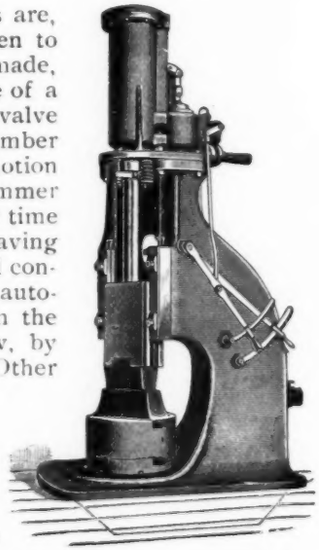

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No. 3 4-spindle Garvin.
32 in. G. & E., back gear.
34 in. Harris, back gear.
38 in. W. & L.

MISCELLANEOUS.

24 in. Lapping Machine.
No. 5 Water Tool Grinder, Springfield.
Centering Mach., Whiton.
Cutting off Mach., H. & R.
24 in. Gear Cutter, G. & E., half automatic.
Lincoln Type Milling Machine.
45 in by 12 ft. hor. Bor. and Drilling Machine.
36 in. Band Saw, B. & O.
Car Mortiser and Borer, B. & O.

We have named above only our choicest tools. Write us for anything you want.

Prices on application.

THE NILES TOOL WORKS CO.

136 Liberty Street, New York City.

14 IN. x 5 FT. Bradford Muller Lathes.

25 of them. Almost New. Low Price.

The Lodge & Shipley M.T. Co. Cincinnati, O.

U. BAIRD MACHINERY CO.

523-525 Water St.; 524-526 First Ave., PITTSBURGH, PA.

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No. 19 Bliss Press.
4 in. Cox Pipe Cutter.
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100 lb. Merrill Hammer.
80 lb. Merrill Hammer
3 in. x 48 in. Hand Bending Rolls.
Drilling and Slotting Machine.
3-Spindle Pratt & Whitney Drill Press.
No. 2, 3-Spindle Garvin Drill Press.
No 1, 3-Spindle Garvin Drill Press.
48 in. Pulley Borer.
No. 2 Brainard Milling Machine.
36 in. x 28 ft. Betts Lathe.
36 in. x 14 ft. New Haven Lathe.

WANTED.

One 5 to 6 foot Planer.

One Horizontal Boring Mill, with 7 to 8 foot bar.

1,000 lb. Steam Power Hammer.

Traveling Crane of from 12 to 15 ton capacity.

MACHINERY, care of American Machinist.

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1 16½ H. P. Slide Valve Otto Gas Engine, complete, with fly-wheel and belt pulley.....	$275
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1 8 H. P. Otto Gas Engine, without iron base, otherwise complete	175
1 7 H. P. Charter Gas Engine, with base, fly-wheel and pulley.....	200
1 3½ H. P. Gas Engine, Upright, with fly-wheel and pulley.....	125
1 2½ H. P. Olds Gas Engine, Upright, two fly-wheels and pulley.....	185
1 2½ H. P. Otto Gas Engine, Upright, with fly-wheel and pulley.....	140

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We have rented

an additional warehouse at No. 65 South Canal Street, and will place in same a large consignment of both new and second-hand Machine Tools, which will be offered at special prices.

Almost two hundred machines in stock.

Do not fail to write us before purchasing.

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84 in. x 20 ft. Cleveland, triple geared.
62 in. x 22 ft. Putnam, triple geared, fine.
80 in. triple geared Pitt lathe.
72 in. Pitt lathe.
30 in. x 12 ft. Smith, compound rest.
25 in. x 10 ft. Pratt & Whitney, C. R. & P. C. feed.
23 in. x 8 ft. Putnam, R. & F.
21 in. x 12 ft. Wright R. & F. rest and two chucks fitted.
21 in. x 10 ft. Fifield, C. R. & P. C. feed.
20 in. x 8 ft, Fifield, C. R. & P. C. feed.
18 in. x 21 ft. lathe, P. G. rest.
18 in. x 8 ft Fitchburg Mach Co., C. R. & P. C. F.
18 in. x 6 ft. McMahon, C. R. & P. C. feed
18 in. x 6 ft. Eddy, P. G. & P. C. feed,
18 in. x 6 ft. Lodge & Davis, P. G. & P. C. feed.
16 in. x 6 ft. Bullard, R. & F. & P. C. feed.
18 in. x 10 ft. Sebastian-May, C. R. & P. C. feed.
18-20 in. x 7 ft. Pond, P. G. rest, 12 in. 4-jaw chuck (independent).
17 in. x 8 ft. Putnam, R. & F. & P. C. feed.
16 in. x 6 ft. Nutter-Barnes, R. & F. rest, fine.
15 in. x 6 ft. Pond, R. & F. rest.
15 in. x 6 ft. Prentice Bros., R. & F. rest.
15 in. x 5 ft. Star Tool Co., R. & F. & taper attach.
14 in. x 7 ft. Grant & Bogart, R. & F. rest.
14 in. x 6 ft. Blaisdell, R. & F. rest and 9 in. combination chuck.
14 in. x 6 ft. Putnam, R. & F. rest.
3 14 in. x 6 ft. Lodge & Davis, C. R. & P. C. feed.
14 in. x 5 ft. Porter, R. & F. rest, 1⅝ in. H. S. and 6 in. combination chuck.
2-12 in. x 5 ft. Star, P. G. & P. C. feed.
3 13 in. x 5 ft. Pratt & Whitney stud lathes.
Also a number of pulley, turret, brass and speed lathes.

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Radial, 7 ft. arm, swiveling head.
64 in. Bickford, boiler makers', good as new.
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3-spindle Barnes, 20 inch swing.
No. 2 24 in. Harrington tapping drill.
No. 5 Stow flexible shaft drill.
No. 4 Stow flexible shaft drill.
Stow (perfection) flexible shaft drill, all attach.
12 in. 1-spindle sensitive drill, with chuck.
Also a number of 2, 3 and 4 spindle gang drills.

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48 in. x 48 in. x 12 ft. Putnam Machine Co., A1.
42 in. x 24 in. x 16 ft. Bement.
30 in. x 30 in. x 8 ft. New York Steam Engine Co.
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24 in. x 24 in. x 8 ft. Pratt & Whitney.
24 in. x 24 in. x 7 ft. New Haven.

SHAPERS.

32 in. Prentiss friction, all attachments.
24 in. Walcott shifting belt.
24 in. Hendey friction.
15 in. Hendey friction, latest pattern.
12 in. Warren traveling head, fine.
16 in. Gould & Eberhardt crank.

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Grant & Bogart, double column, back geared.
4-spindle Warner & Swasey, fine.
No. 3 Brainard universal, back gears.
2 No. 3 Garvin hand, without arm.
No. 1½ Pratt & Whitney hand, without arm.
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MISCELLANEOUS.

2 ⅛ Adt riveting machine and countershafts.
Set 8 in. power bending rolls.
12 in. New York Steam Engine Co. slotting mch.
3 H. P. Westinghouse motor, practically new.
2 spindle Whiton centering machine.
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30 INCH TO 30 FT. SWING.

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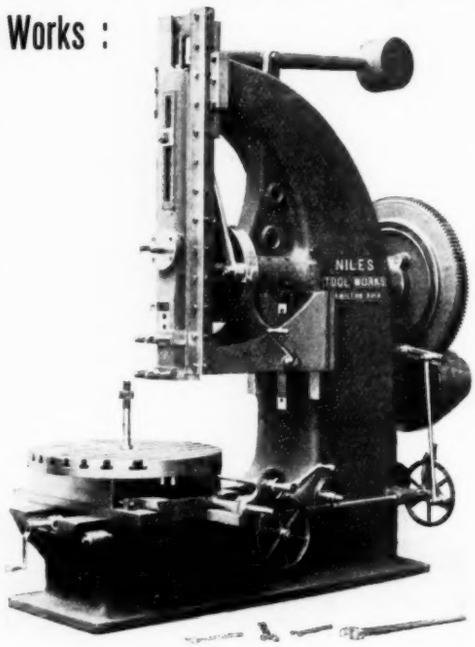

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List No. 21

of New and Second-Hand Machine Tools in stock is now ready,

OVER 800 MACHINES

in stock for immediate delivery are listed.

The Garvin Machine Co.,
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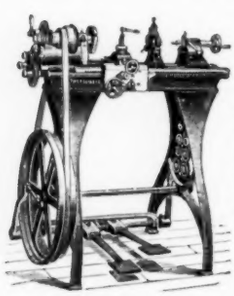
51 No. 7th St., Philadelphia, Pa. **NEW YORK.**

The "RELIABLE" 1898 SCREW CUTTING LATHE.



A perfect tool for machine shop, repair shop or amateur use.

Has a friction and screw feed, power cross feed, bicycle foot motion, and many other new attachments.

Made in two sizes, 10 x 25 and 10 x 36 inches.

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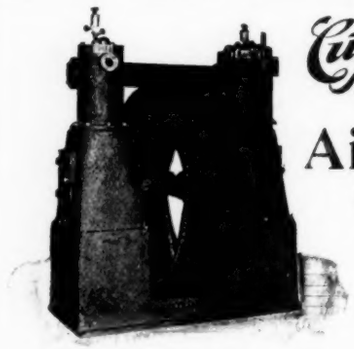

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built by us are of the highest grade, combining simplicity of design and maximum capacity. We shall be pleased to send you all particulars on request.

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Pioneers of only Successful Safety System of using
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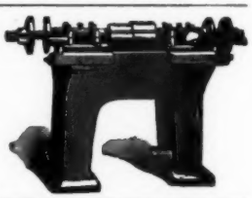
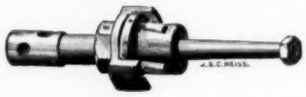
Grinding Machinery of All Kinds.
Write for Catalogue. **SPRINGFIELD, OHIO.**





This is Ferguson's patent Tube Expander. Self-feeding, no hammering necessary. Patented by a practical man who know what Expanders ought to do and do easily.

This is the plain roller kind of Tube Expander. Some people prefer this kind because they are used to them. The choice is yours. There are other kinds made by us, too. All shown in the little book.

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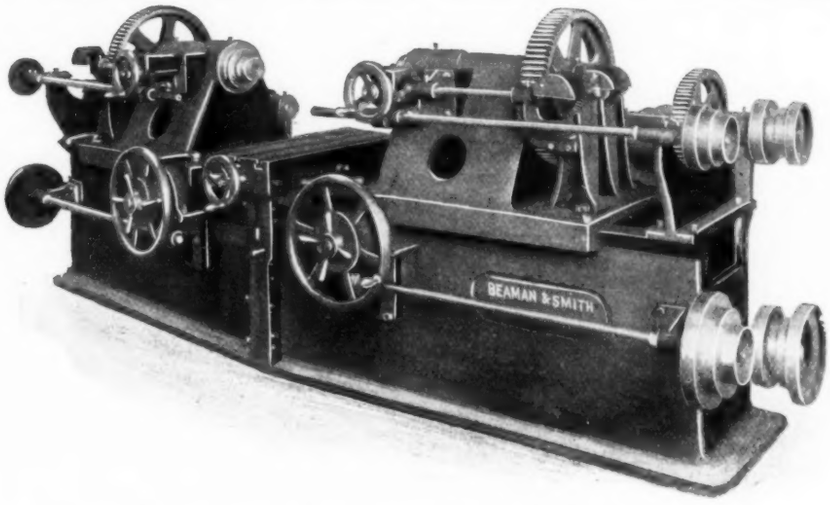
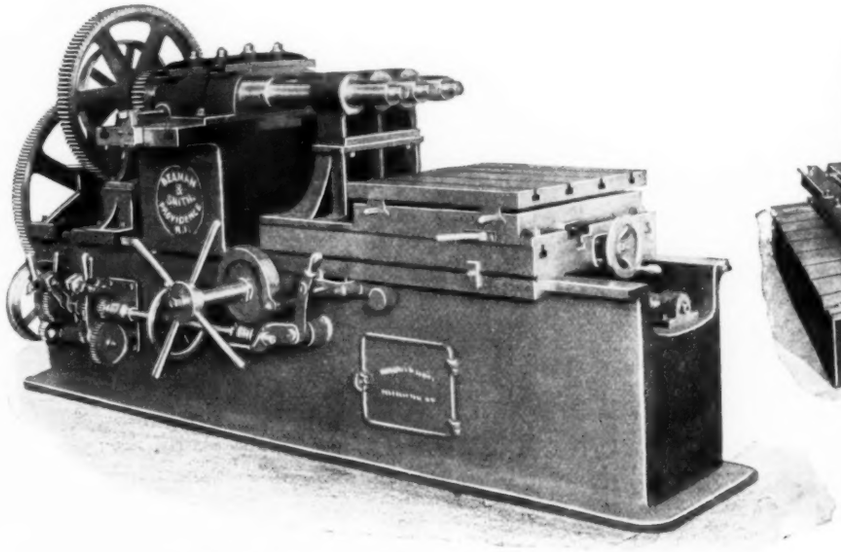
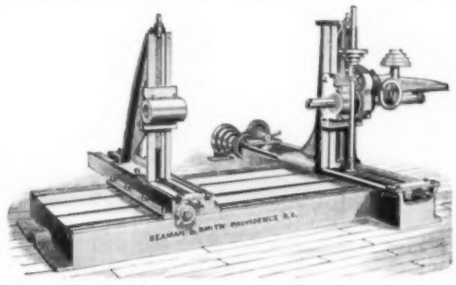


Valve Seat and Body Boring, Facing and Threading Machine,
Weight, about 11,000 lbs. Patented June 15, 1897.
We are prepared to furnish Boring Machines and shall be pleased to hear from you.



Triplex Pump Boring Machine. Weight, 12,000 lbs.



No. 1. Horizontal Spindle Drilling and Boring Machine.
Weight, 6,500 lbs.

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Adolph Janssens, Paris.
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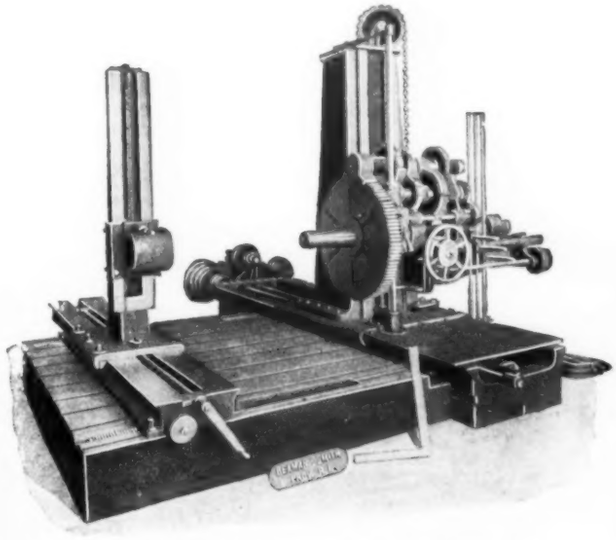

Horizontal Spindle Drilling, Tapping, Boring and Milling Machine.
Weight, about 31,500 lbs.

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The Perfection of Pipe Threading

is admitted to be reached when our
No. 9½ PIPE THREADING MACHINE
is used. As a hand machine it is the only one known that will cut and thread an 8 inch pipe with ease and satisfaction. One valuable feature is, that it has no arbitrary lead screw for determining style or pitch of thread to be cut. *Send for Catalogue.*

THE MERRELL MFG. CO.,
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A New Turret Lathe for Finishing Castings.

New Driving Gearing,	New Feed Works,
New Chuck,	New Turret,
New Tools,	New Manipulating Gear,
New Stop Motion,	New Process.

A good and sufficient reason behind each novelty.

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We make engravings

for anyone desirous of having them made properly. These engravings are not the cheapest that can be obtained, but the trifling extra cost over the "how cheap" kind is expended in the production of a very much better printing plate.

American Machinist, 256 Broadway, New York.

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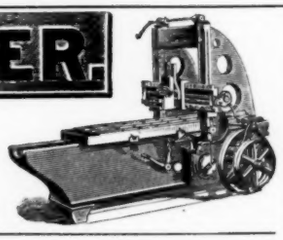

The G. A. Gray Co.,

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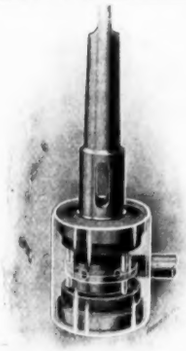
Manufacture Planers as an exclusive specialty.
Planers only! Nothing but Planers!!

William Sellers & Co. Incorp. **PHILADELPHIA.**

NOTE.—An important feature of our **MODERN LABOR-SAVING MACHINE TOOLS** is the convenient grouping of all of the operating levers and handles, thereby permitting the attendant to make necessary changes with rapidity and ease. This is one of the little details of construction which conduces not a little to the large capacity for work of our machine tools, as well as to the comfort of the operatives.

PULLEYS and SHAFTING. | Boring Mills, Bending Rolls, Bolt Cutters, Cranes, Lathes, Planers, Slotters, Punches and Shears, Mechanical Stokers, Turn-Tables, Testing Machines, Etc. | **INJECTORS for ALL SERVICE.**



Chucks for Taper Shank Drills, with provision for conveying Lubricant to Cutting Lips.

By the use of these Chucks drills of this type can be used in an ordinary drill press, the lubricant being supplied by a small rotary pump.

The sleeves of these chucks being packed with cupped leather packings are tight and do not leak the lubricant under pressure.

To secure the full advantages of this system of drilling, the lubricant should be supplied under considerable pressure, which the construction of the chuck illustrated admits.

Made for Nos. 2, 3, 4, 5 Morse Taper. Prices on application.

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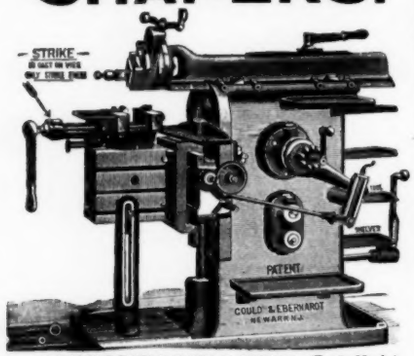

"DOUBLE TRIPLE QUICK" STROKE (Trade Mark.)
Gives 100 per cent. more strokes per minute than any other Shaper made. **Write for our Shaper Catalogue.**

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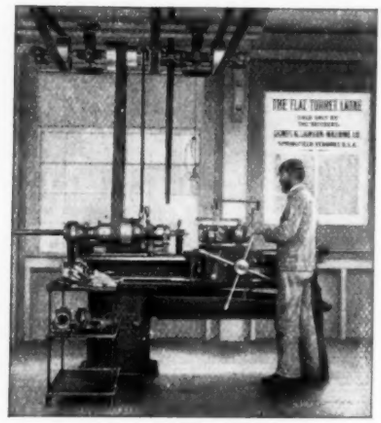

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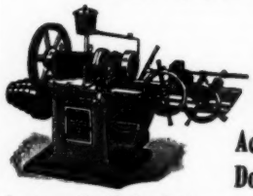

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